THE

ANATOMY

OF THE

HUMAN BODY.

CONTAINING

THE ANATOMY

OF

THE BONES, MUSCLES, JOINTS, HEART, AND
ARTERIES,

By JOHN BELL, Surgeon;

AND THAT OF

THE BRAIN AND NERVES, THE ORGANS OF THE
SENSES, AND THE VISCERA,

By CHARLES BELL, Surgeon;

THE THIRD EDITION.

IN THREE VOLUMES.

VOL. II.

THE

ANATOMY

OF THE

HUMAN BODY,

## VOL. II.

CONTAINING

THE DESCRIPTION

OF

THE ARTERIES AND THE VEINS,

By JOHN BELL, Surgeon.

THE ABSORBING SYSTEM,

AND

THE BRAIN AND NERVES,

By CHARLES BELL, Surgeon.

A 2

DR. JAMES JEFFRAY,

PROFESSOR OF ANATOMY IN THE UNIVERSITY

OF GLASGOW.

Dear Sir,

Wʜᴇɴ this volume firſt appeared, you mentioned to me ſome doubts concerning the office which I had aſcribed to the Euſtachian valve. You propoſed to publiſh ſome critical obſervations on this part of my Book, and, with a liberality becoming our common profeſſion, and your high ſtation in it, you ſpoke of addreſſing thoſe ſtrictures to myſelf.

It is no ſmall gratification to me, that I have it now in my power to preſent a new Edition of this Volume, imperfect as it is, to one who allows it ſome merit, while he is yet not inſenſible to its defects.

I believe

I believe you will accept with pleafure this flight teftimony of refpect and efteem, from one who can have no motive but refpect and efteem for profeffing himfelf in this particular manner

   Your moft faithful and obedient
    Humble Servant,

      JOHN BELL.

INTRODUCTION.

THE difcovery of the circulation of the blood has been always regarded as one of the moft important, and has been ranked rather with the great doctrines of philofophy, than with the little difcoveries in our peculiar fcience; it has been boafted of by our countrymen, and much coveted, and often claimed, by ftrangers. The difcovery is moft ingenious and beautiful, and is the foundation of all that phyficians have thought or practifed, right or wrong, ufeful or deftructive, ever fince.

How the well-proved doctrines of Harvey were perverted; what new, ftrange, monftrous, and impoffible circles his antagonifts contrived for the blood it were tedious to relate; but it is moft natural to mention why his doctrines were oppofed. It was the univerfal opinion in thofe days, that the blood was formed in the liver, and fent out from it by all the veins to nourifh the body, proceeding outwards during the day, and returning by night. The old phyficians had thus entered into a train of thinking which it was not eafy to change: thefe notions about the blood were become great and important doctrines, and had defcended to them from their oldeft teachers, with many weighty dependencies, conclufions, and rules of practice iffuing from them: they were as articles of faith which it was a herefy to forfake; and it was eafy to forefee, that fhould the Harveian doctrine prevail; fhould it be once completely proved that the blood moved outwards along the arteries and returned only

by

by the veins; then all the reafonings of the phyficians would be confounded; their theories embracing the whole body of phyfic difturbed; their fyftem of practice entirely overthrown; and all that they had written themfelves, and all the ancient books which they had read with fo much diligence (for they were really learned); all that they had ever been proud of; was to be wiped out from the thoughts of that and of all fucceeding ages!

But the doctrine of Harvey did at laft prevail, difpelled thofe idle dreams of humours and temperaments, and fpirits, and blood! of the blood concocted in the liver, and moving outwards along the veins to nourifh the body; of the blood moving outwards during all the day, and returning by night; of the arteries carrying air only or vital fpirits, to animate the fyftem by mixing with the blood, while the veins alone conveyed the proper blood. Yet this theory of the illuftrious Harvey introduced general doctrines more mifchievous in all their confequences than thofe which had juft vanifhed: as, that the blood was compofed of particular globules, the larger globules of fmaller ones, and thefe again of globules of a third feries; and that the arteries were fo proportioned to the diameters of thofe globules, and defcended by fteps fo regular and uniform, that each kind of artery had its peculiar globule which it received with eafe, while others were rejected; or, if unhappily driven by a too violent action into veffels which they did not fuit, were arrefted in their progrefs; and produced either fome local inflammation or fome univerfal difeafe. Thefe are the once famous doctrines of Malpighi, Boerhaave, and all the great men of their day; and which they dilated into various forms, and adorned with the fine words of lentor, remora, error loci.

To thefe fucceeded the mechanical phyficians, who, by unintelligible problems of mathematics and algebra (reafonings which were ill-founded in their principles, even had the calculations been correct), pretended to eftimate the force of the heart, the velocity of the

blood,

blood, the power of the arteries, the strength of the veins, and the shape and size of each secreting orifice, according to the secretion which it had to perform. These were the doctrines, these the discoveries, which rendered famous the names of Bellini, Pitcairn, Keil, Hales, and other mechanical physicians, whose books are gone " to the vault of all the Capulets."

The chemists next soon turned their thoughts, from the vain search after the universal solvent and the philosopher's stone, to pharmacy and the useful arts. By the abilities and industry of Newman, this branch began to assume the more respectable appearance of a useful art; it began to be allied to science, and its connection with medicine was found to be of the most direct and important nature.

Having analysed the materials of the druggist, the chemists proceeded to analyse the parts of the human body to which those medicines were to be applied : but from this rational commencement followed one of the most trivial of all the miserable doctrines with which our science has been disgraced ; for as the chemists had already explained the properties of the salts, metals, earths, and of all active substances, by the angles, cubes, or other forms which they saw their particles assume, they soon persuaded themselves that such forms as cubes, wedges, spiculæ, &c. existed in the blood; and acid and alkaline humours, sharp, corrosive, irritating, and pointed particles, were the terms in which they expressed their most admired theories ; and acids, alkalis, and metals, and medicines for rounding the pointed particles, or obtunding (as they termed it), or sheathing, or covering the acrimonious humours, were their chief preventatives and cures.

Until the present day this fault has pervaded all the great theories, that in describing our vessels physicians have continued to use the language of hydraulics and hydrostatics ; of a philosophy applicable only to rigid tubes : in short, in describing the living system, they have forgotten that it was endowed with life.

We

We alfo may have erred in our turn : but with whatever degree of contempt we may view the doctrines of thefe older authors ; or however fucceeding generations may be amufed with ours—ftill this is plain, that the moft important facts in all anatomy, and the chief doctrines of the human body, muft always accompany the explanation of thofe two great functions of the heart and lungs. Of courfe the conftitution of the blood ; the chemiftry of airs ; our dependence, fo inceffant and immediate, upon the atmofphere in which we live ; the various and fingular ways by which the fœtufes of different creatures, or the creatures themfelves, according to their peculiar modes of life, draw their exiftence from the atmofphere ; the various kinds of circulation by which this air is diftributed through the fyftem of each ; the effects of air particularly upon our body ; and the effects alfo of accidents, deformities, and difeafes in thofe prime organs—all this wide circle of phyfiology belongs, in the ftricteft and cleareft fenfe, to the anatomy of the heart. For one chief purpofe in ftudying the anatomy of the human body is to underftand its functions, and to compare them with thofe of other creatures, till we arrive at laft at fome diftant conception of the whole ; of the various ftructures of animals and vegetables ; and of the various functions which in each of thefe claffes fupport life, and action, and through it the principle of life.

There is no occafion on which this defire of knowledge, this willing admiration of the wonders of nature, is fo ftrong as on firft ftudying the functions of the lungs and heart ; for upon the conjoined offices of the heart and lungs all perfect life feems to depend. And how univerfal thefe two functions are ; how neceffary to the fupport of the greater animals ; how effential alfo to the conftitution of the meaneft infect—it fhall be my bufinefs to explain.

The knowledge of the arteries again bears along with it the whole anatomy of the human body. The nerves accompany the arteries ; the lymphatics and veins

veins twine round them; the glands and various organs are compofed of them. The intimate ftructure of parts is known only by underftanding the forms of of their veffels; and as each individual part is nou-rifhed by arteries, he who has ftudied the arteries thoroughly, knows the whole.

But to the furgeon the knowledge of the arterial fyftem is valuable beyond all calculation or belief. He performs no operation in which arteries are not en-gaged; he cures no great wound in which arteries are not firft to be tied; he enters into no confultation in which the arteries are not firft fpoken of. Without a knowledge of the arteries he can neither think fenfibly nor act fafely.

Moft unhappily all this comes to be known only at that period of life when the deepeft conviction can produce only fear and perplexity, forrow and regret. Yet, ftrange to tell, there is no fuch conviction; no regret, no irrefolution, no perplexity, is ever feen! A furgeon, as ignorant of the blood-veffels as of every other point of anatomy, fhall proceed in his opera-tions with a forwardnefs and boldnefs terrible to thofe who know the danger; yet with a fuccefs and good fortune exceeding all belief.

The caufes of all this are very plain. A relaxation in the difcipline of the fchools is the firft caufe—an indifference to anatomy, fo marked and pointed, that an anatomical thefis in this country was never known. Every young man efpecially fears the difficulty of this part of anatomy, and fhuns it. He is not duly im-preffed with fuch a high fenfe of its importance as to make labour pleafant; and when he is advanced to practice, he takes comfort daily from the miftakes and ignorance of others. A flender confolation! to fee ex-emplified in others the faults and dangers to which we ourfelves are expofed.

If thefe negligencies may ftand excufed on any ac-count, it is on this only, That anatomifts have been accuftomed to write, not for the Public, in plain and fimple language, but for each other in an unknown tongue.

tongue. By this I mean not a foreign or a dead lan-
guage, but a peculiar ftyle and phrafe which no one
can underftand unlefs he be initiated; unlefs he have
ftudied the fcience itfelf fo intenfely, that he has alfo
learned the jargon in which it is conveyed : in fhort,
no one but a thorough anatomift can underftand the
language of anatomy, nor can even he underftand it
without fome labour. Anatomifts have buried their
fcience under the rubbifh of names ; there is not a
difficult or hard founding word upon which they have
any claim, that they have not retained : they have
choked their fubject with ufelefs minutiæ, they have
polluted their language, by transferring to it from
Latin many words which, by their continual inflections
in that language, were beautiful ; while their unvaried,
uncouth termination in ours, is barbarous in the ut-
terance, while it tends but to interrupt and puzzle the
fenfe : " they have impreffed into the fervice of their
fcience a great many poor words that would get their
habeas corpus from any court in Chriftendom."

An anatomift, for example, will defcribe an artery
as " going to the radial edge of the fecond metacarpal
bone : then fupplying the abductor and flexor mufcles ;
then going along the bone of the firft phalanx, feated
upon this fecond metacarpal bone," with many other
diftortions, ambiguities, and little contrivances, to
conceal (as one would believe) that he is defcribing fo
fimple a matter as the artery of the forefinger ; which
the reader at laft finds out either by fome lucky chance,
or by reflecting how many metacarpal bones there
are ; and then reckoning them firft forwards and then
backwards that he may be fure which it is that the
author means ; for his author may count from the
little finger towards the thumb, or from the thumb
towards the little finger, or he may have a fancy of
leaving out the thumb, and reckoning only four.
What muft be the furprife of any well-educated young
man when he reads in thofe books which he muft
ftudy, of the regions of the elbow or thumb, or fore-
finger ? And if an anatomift underftands fuch things
                                                    with

with difficulty, how diftreffing muft they be to the ftudent?

This is the fcholaftic jargon which has fo long been the pride of anatomifts and the difgrace of their fcience; which has given young men a diflike for the moft ufeful of all their ftudies; and which it is now full time to banifh from our fchools. Thefe are the authors who avoid plainnefs as if it were meannefs; who are ftudious of hard words as if they conftituted the perfection of fcience: " it is their trade, it is their myftery, to write obfcurely;" and full forely does the ftudent feel it.

Want of arrangement, again, has ftill worfe effects. Confufion is a monfter in fcience; and Thomfon has, in his Man of the Moon, defcribed fuch a thing with great fpirit and life: " A creature, if that may be called a creature which had no fhape nor form, next rolled towards him, approaching ftill nearer and nearer, and by various glances and movements feemed to indicate a fympathy with man: it was a rude unformed mafs; legs and arms, fingers and toes, and membranes and glands, and entrails and teeth, were blended into one abominable mafs."

If I fhould tell my reader that there are very nearly one thoufand arteries in the body, going promifcuoufly to bones, ligaments, bowels, and glands, mufcles, and nerves, to a thoufand unconnected difficult parts, all of which he muft know by name, how would he be affected? But when I obferve, that thefe go to the neck, the head, the arm, the leg, he begins to fee this confufion of mufcles, and glands, and bowels, vanifh, and to perceive that all thefe arteries may be ufefully and very fimply arranged. When he is next taught to know the courfe of each greater artery, and the parts in which each divifion and branch of it lies, he perceives clearly that the parts through which it runs, as the arm-pit, neck, or groin, muft limit and regulate the number of its branches, and give to each twig even an appropriate place and name: When next the whole arterial fyftem is marked and chalked out

for

for him in different portions; when there are points of peculiar importance fet apart which he is charged to learn with particular care—he fees a good end in all this toil; he begins with courage, and gets forward eafily; it becomes an interefting, and of courfe a pleafing, tafk. But ftill it is a tafk: and I entreat the young ftudent, as he values his own honour, or the fafety of his friends, not to bate himfelf one iota of the whole. Let him not take an indolent advantage of thofe arrangements, which are meant to promote his induftry, not to prevent it. Let him not read only concerning the greater arteries, neglecting the fmaller ones, but go through the whole piece of anatomy honeftly and fairly. He will no doubt forget in time the fmaller arteries; but by having ftudied even them with diligence, he muft remember the great and important arteries with a clearnefs of comprehenfion and arrangement, which thofe who have not gone thus honeftly through the whole ftudy can never attain. Let him alfo remember, that ftudies like thefe, well performed during his early years, do, like paft dangers, or the remembrance of good deeds, give an eafe and pleafure to his after-life.

The arteries, I will now venture to fay, fhould be with the furgeon as familiar as his name; and there is no argument which proves it more ftrongly than this, that a man of real learning, of fterling good-fenfe, of a clear head and fteady hand, a man accomplifhed in all other refpects, and fitted by nature and genius for performing the moft difficult opeiations, if yet he want this part of knowledge, may, in one unhappy moment, do things which he muft think of with horror during all his life. I know well how fuch little accidents are thought of, when at laft the evil day comes. A furgeon hardly believes this ftrict knowledge of the arteries to be fo great a point. In the midft of an operation, or in a common wound, it gives him no concern to fee arteries bleed which he did not look for; nor has he great reluctance to drive his needle among parts which he does not know. An artery bleeds, and he

looks

looks for it; he call out at laſt to ſcrew the tourniquet, and it ſtops; the tourniquet is loofened again, and again it bleeds; again the ſcrew is tightened on account of the lofs of blood; he expects to ſtrike the artery; he is accuſtomed to ſtrike it, not by knowing where it lies, but by ſeeing it bleed: at laſt ſome lucky dab of the needle ſucceeds, or perhaps from faintneſs of the patient the bleeding ceaſes: the furgeon is relieved from his preſent anxiety; but in a few hours he is called back to this ſcene of confuſion and diſmay: yet at laſt the bleeding is ſomehow or other maſtered; and thus he gets on through all his difficulties, accident after accident, operation after operation, till at laſt he almoſt forgets that anatomy was a branch of his education, or the knowledge of blood-veſſels neceſſary in operations or wounds.

I will not ſay that a man cannot ſupprefs a bleeding from a wound in the arm, becauſe he is not acquainted with the anatomy of the arm; but this furely I may be allowed to ſay, that it is a piece of knowledge which at all times, but eſpecially in thoſe circumſtances, can do no harm; and that if you leave a patient to chooſe betwixt two furgeons, one ſkilled in the knowledge of arteries, another knowing them only by ſeeing them ſpout out blood, it is eaſy to foretel where his choice will fall.

Perhaps ſome will be ſo hardened as to ſay, " and yet we ſeldom hear that patients die of bleeding." Is it then a merit that your patient is not plainly killed; that he does not expire under your hands? Is it nothing to loſe blood from day to day? Is it nothing that your patient is reduced to extreme weakneſs, ſuffering every thing but actual death? Is it nothing that he lies with tourniquets round the limbs in fear and anxiety, attended by young furgeons appointed to watch that bleeding, which may burſt out while the patient turns in bed, and deſtroy him in one moment? Is it nothing to have freſh inciſions and new ſearchings for the artery to endure?—Theſe are real difficulties and dangers, and they ſhould be provided for; our honour as well

as

as our duty requires it. Bleeding from a great artery is to the patient the greateft danger : the very report of an ill accident is to the furgeon (though, God knows, he may be blamelefs) the greateft difgrace ; and, laftly, though it fhould not be fo, his taking up a bleeding artery dexteroufly and quickly, when others have failed, is a great honour.

When we think of all the important confequences of being thoroughly verfed in this part of anatomy, they crowd upon our imagination more in number than can be even named. The furgeon may, indeed, provide for the arteries to be cut in a regular operation, by confulting books ; but when he is called to a patient bleeding and faint, perhaps expiring, that perfon muft live or die by his immediate fkill ! By his fkill he will obtain the good opinion, not of ignorant attendants only, but of the profeffion : and by a bold and fenfible conduct in any difficult fituation he may give them a leffon of real ufe. Let us but for a moment think of the chances of thofe wounded in war ;—the alarming, unthought of accidents which overtake us daily in private life ;—the wounds and hurts which workmen receive :—let us reflect on all the kinds of aneurifm both in the heart and arteries, from wounds, from blows, from inward difeafes :—let us think of all the various operations in which arteries are concerned— and then declare whether, of all his ftudies, the young man fhould not value that moft which makes him fo immediately and eminently ufeful.

CONTENTS

OF

THE SECOND VOLUME.

ANATOMY

OF THE

HEART AND ARTERIES, continued.

BOOK I.

RESPIRATION, continued.

CHAP. III.

OF RESPIRATION, OR THE MANNER IN WHICH THE OXYDATION OF THE BLOOD IS ACCOMPLISHED IN VARIOUS ANIMALS, AND IN MAN.

CHAP. IV.

OF THE PECULIARITIES IN THE CIRCULATION OF THE FŒTUS.

CHAP. II.

OF THE ARTERIES OF THE ARM, 158.

                                                     CHAP.

CHAP. III.

OF THE ARTERIES OF THE THORAX, ABDOMEN, AND PELVIS.

CHAP. IV.

ARTERIES OF THE LOWER EXTREMITY.

Arteriæ

CHAP. V.

ON THE STRUCTURE AND ACTION OF ARTERIES.

CHAP. VI.

OF THE VEINS IN GENERAL.

CHAP. VII.

Pofterior

PART IV.

OF THE LYMPHATIC AND LACTEAL SYSTEMS OF VESSELS.

CHAP. I.

CHAP. II.

ANATOMY

ANATOMY

OF THE

BRAIN AND NERVES.

———

CHAP. III.

CHAP. IV.

Fourth

CONTENTS.

xxvii

Tibial

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THE
A N A T O M Y
OF THE HEART,

AND OF THE
ARTERIES, VEINS, AND LYMPHATICS.

BOOK I.
RESPIRATION continued.
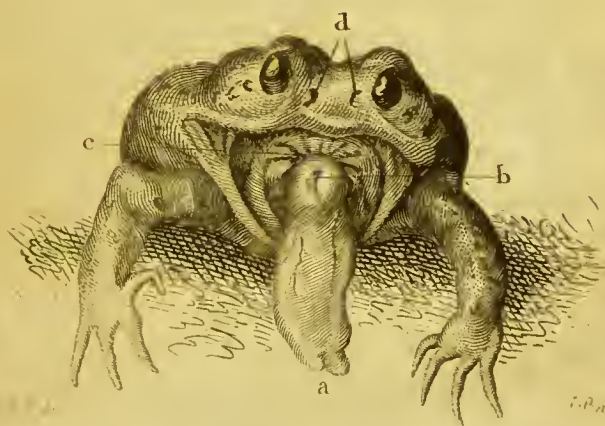
CHAP. III.

OF RESPIRATION,

OR THE MANNER IN WHICH THE OXYDATION OF THE BLOOD IS ACCOMPLISHED IN VARIOUS ANIMALS.

THOSE who are the beſt acquainted with the comparative anatomy, will beſt know how natural it is for me to illuſtrate this function, by comparing various

rious animals with man ; how pleafant, how ufeful, it is
to know thefe analogies, every ftudent muft feel : and
it is now full time to correct many miftakes into which
modern as well as ancient authors have wandered, from
want of general principles, and from want of anato-
mical knowledge.   I fhall endeavour to make this chap-
ter interefting and fhort.

At one time all authors believed that the lungs were
moved, not by any external agent, but by fome internal
power refiding in the lungs.

When in their firft effays to inveftigate this fubject
they opened the thorax, or rather the body, of amphi-
bious animals, they obferved that the creature lay out
upon the table with expanded lungs ; that the lungs
continued for hours to appear like inflated bladders ;
the lungs expanded, the heart playing, the creature
quite alive.   When they emptied their lungs for them
by thrufting tubes down the trachea, or prefing the
lungs, the lungs entirely fubfided ; but in a little while
the lungs, at the creature's will, rofe again into complete
inflation ; again they appeared like two tenfe bladders.
Surely, faid they, there refides fome expanfile power
in the lungs themfelves ; but when a few of them began
to purfue this miftake with ferious experiments, they
committed abfurdities which fhould be noticed, for they
ferve to illuftrate the true doctrine concerning the ex-
panfion of the lungs.

Mr. Houfton, in our Philofophical Tranfactions,
undertook to prove the following things, which, to ufe
the words of a learned author in our univerfity, " are
fo improbable as to be incredible ;" firft, that the
breathing of a dog is nothing affected by any wound
of the thorax, if only the lungs themfelves be not hurt ;
fecondly, that the lungs never collapfe, though the
thorax be laid open ; thirdly, that when the breaft is
entirely laid open, the lungs continue to move, and the
thorax alfo continues to move, but that the motion of
the thorax never keeps time with the motions of the
lungs.   But, to do Houfton juftice, he endeavoured to
                                                    ex plain

explain away the inconſiſtencies of his own experiments ;
and the world would never have been troubled any
more with them, had it not been for a Mr. Bremond, a
great academician, philoſopher, and experiment-maker,
who publiſhed the following ſuite of experiments in the
academy of Paris.

His firſt miſtake is this. " I found (ſays he) that
having ſtabbed a Dog in one ſide only, it could run
about the houſe and howl." This is what nobody will
doubt. " But alſo (ſays he) the air which the Dog
took in by the wound when it expired, was preſſed out
again by the wound when it inſpired." This is one
cunning ſtroke of Mr. Bremond ; for had the air en-
tered the cheſt during inſpiration, that muſt have pro-
ceeded from the riſing of the thorax, which is not the
kind of reſpiration which he wanted to prove : But as
the air entered the cheſt during expiration, it proceeds
clearly, according to his principles, that the lungs in
ſqueezing out their air have a contractile power ; that
they contract by their own motion, and leave the ribs,
and ſo make room for the air.

" Next (ſays Mr. Bremond) I opened the thorax of
a living Dog, and there I ſaw, that when the lungs con-
tracted the thorax dilated, and when the thorax con-
tracted the lungs dilated."—But, in fact, it means no
more than this, that often in theſe agonies produced by
ſuch cruel experiments upon animals; or by actual
wounds in the human body, the diaphragm, cheſt,
every thing which contributes to breathing, is ſo cloſely
contracted, and the preſſure is ſo great, that the lungs
are actually compreſſed and protruded: ſo that his ſeeing,
as he ſays, the lungs dilated, that is, ſqueezed out,
when the thorax contracted, is like the ignorance of a
child looking from a carriage window, who believes and
wonders at the trees and houſes running backwards.
But as no experiment-maker ever allows his experiments
to remain incomplete, Mr. Bremond finiſhes his by the
following daring aſſertion, " that always when he made
his inciſion no more than three inches long, the lungs
dilated themſelves with ſo much violence that they drove

out

out the air before them, protruded themfelves through
the opening, and made the blood jerk out at all
points *." In fhort, he repeats this miftake in every
poffible form, viz. that the motions of the lungs and
thorax are directly oppofite to each other; that the
lungs are contracting while the thorax dilates, and the
thorax contracting again when the lungs dilate. When
I open a Frog, it fills its lungs with perfect eafe after
both its breaft and belly have been entirely cut away.
" If admitting air into the thorax could really make the
lungs collapfe, why do not thofe of the Frog collapfe?"
This is fuch grofs ignorance as fhould not have been
endured in one reading papers before the Royal Aca-
demy of France. He is farther back in phyfiology than
Oligerius, Jacobæus, or Malpighi.—The Frog has a re-
fpiration peculiar to itfelf, or at leaft to its kind.

FIRST SPECIES OF RESPIRATION, VIZ. BY A DIA-PHRAGM.

Under this title I fhall explain the refpiration of Man,
and of animals like Man; which have heavy lungs, of
a ftrong flefhy texture, a prodigious number of blood-
veffels paffing through them, their lungs lodged entirely
in the cheft, and their refpiration performed by a dia-
phragm.—I mean to arrange refpiration according to the
mechanifm of thofe organs by which it is performed;
and place in the firft order that of Man, and animals
which in this point refemble Man; and I fay refpiration
by a diaphragm, for this is indeed the only ufe of a
diaphragm. The fupport of the great blood veffels, the
compreffion of the vifcera, the expulfion of the urine
and fœces, the ridding the womb of its burden; all
could have been performed by the preffure of the abdo-
minal mufcles alone! the diaphragm is added merely
for breathing.

* If one word of this were true, what would become of thofe who
had adhefions of the lungs? Surely if the lungs and thorax moved
in oppofite directions, the one contracting while the other dilated,
the force of the lungs never could pull down the thorax.— Such
patients muft die.

Forfaking,

Forſaking, for a moment, authority and minute ana-
tomy, let us explain it in the ſhorteſt and moſt intelli-
gible way.—The diaphragm divides the thorax from the
abdomen ; it is ſtrong, muſcular, and acts with great
power, enlarging the thorax ; it is convex towards the
breaſt, and concave towards the belly : when it acts,
the belly is protruded, the diaphragm becomes flat, the
thorax is enlarged, and a vacuum would be formed, but
that inſtantly the lungs follow it and prevent a vacuum ;
for the lungs are free in the thorax, the air has free
acceſs to go down into the veſicles of the lungs ; and ſo
when the diaphragm retires, the lungs follow it, being
dilated by the preſſure of the air which enters by the
trachea.

But this protruſion of the belly excites the abdominal
muſcles to re-act ; their preſſure reſtores the diaphragm
to its natural form ; when preſſed back again by the ab-
dominal viſcera, it riſes in the thorax, becomes again
convex towards the lungs, the thorax is reduced in
ſize, the lungs are compreſſed, and that air is driven
out again which they had juſt received. The thorax
alſo moves in concert with the diaphragm : and this
motion is moſt curiouſly arranged ; for, firſt, the inter-
coſtal muſcles lift the thorax for reſpiration, in the very
moment in which the diaphragm is preſſing down, and
conſequently at the inſtant when the abdominal muſcles,
which are attached to the lower-borders of the thorax,
are relaxed, ſo that they ſuffer it to riſe. Next, the
thorax is to be compreſſed and pulled down by the ab-
dominal muſcles ; and this happens at the very inſtant
in which the abdominal muſcles re-act againſt the dia-
phragm ; ſo that the abdominal muſcles, while they
thruſt back the diaphragm, pull the lower edges of the
thorax down with great power.

Thus in Man, and almoſt all animals, the reſpiration
is performed by a diaphragm.

SECOND SPECIES OF RESPIRATION,
VIZ. THAT OF BIRDS.

BIRDS are fuppofed to breathe like Man, but have in fact no diaphragm to divide their body ; they have veficles, or air bags extending through the whole body, and connected with the true lungs ; their fternum and ribs expand over the whole, and by their motion move the air veficles, which blow the air through the true lungs ; while the true lungs, far from having any thing to do with a diaphragm, never move.

Every one fkilled either in anatomy or phyfiology muft know, that one of the greateft phyfiologifts of our times has written a long paper about the refpiration of birds, little underftood, and in proportion much ad-mired ; of which function he is fo thoroughly ignorant, as to explain how they breathe with a diaphragm : and until I fet this point right, my arrangement is good for nothing.

" The diaphragm of fowls (fays Mr. Hunter,) is thin, tranfparent, and membranous, and runs acrofs the abdo-men." But if thin, membranous, and tranfparent, it can perform none of the functions of a diaphragm, and muft be merely fuch a membranous interfeptum as fome Amphibiæ and Reptiles have, fupporting the vifcera, or confining them in their place. But he thinks to make good his point by acknowledging the imperfection of this diaphragm ; and adding, that it is moved by certain fmall mufcles, which arife from the inner furface of the ribs, and pull the diaphragm and lungs down. He ftill perfifts in calling it a diaphragm, in the very fentence in which he informs us that " it is perforated in many places with holes of a confiderable fize." Since Mr. Hunter is fo bold as to fay of other authors, that they have too limited notions of a diaphragm, we may be allowed to fay, that his notions of it are as much too liberal as theirs are too confined. But defcriptions and arguments of this kind, where the author is entirely wrong, fhould

I   not

not be tedioufly refuted, nor anfwered in any other way than by a fimple ftatement of the cafe *.

The anatomy of a fowl's refpiratory organs is plainly this.—The trachea having defcended into the thorax, divides into two branches ; of which one goes in a fimple and ordinary manner into each fide of the lungs. The heart, which lies immediately upon this divifion of the trachea, fends into the lungs two great pulmonic arteries, and receives in return two veins. The lungs themfelves are very fmall, denfe, and bloody ; they are fomewhat of the fhape of the human lungs ; they are feated in the very uppermoft part of the cheft, are clofely braced down to the back, and are indeed in part niched in among the ribs, which in birds have their edges very deep. Thefe are the true lungs for oxydating the blood ; they never move ; the air paffes through them in the following way.

Thefe lungs cannot move, becaufe they are braced down by a membrane very thin, and cobweb-like, yet very ftrong. This membrane is a peritoneum, lining at once the whole thorax and abdomen (which ftill are not parted from each other), and it is a covering to the lungs, liver, and other vifcera ; but alfo the fame cobweb-like membrane forms cells, which fill the whole cavity from the neck down to the anus, and from the breaftbone to the back ; and which are fo attached to all the furfaces, being, as I have faid, the lining membrane, that as the breaft moves, thefe cells muft move.

Thefe cells appear at firft fight quite irregular ; and

* For the refpiration of birds, *i. e.* for raifing and depreffing the thorax, I fee many mufcles having a very ftrong analogy with thofe of Man. The pectoral mufcles are amazingly ftrong, and their fcapulas abfolutely fixed, fo that thefe could raife the breaft with great power ; but I fufpect that no fuch power is needed, that the elafticity merely of the fternum and ribs raifes them. There lies under thefe, upon the back, a very ftrong mufcle like our ferratus pofticus. There lies on the infide of the ribs a fet of three beautiful mufcles like large intercoftals : they are quite infulated from all other parts, are feen inftantly upon opening the belly : thefe are what Mr. Hunter calls Mufcles of the Diaphragm ; but in truth the breaft of a bird is pulled down ftrongly by its fhort yet ftrong abdominal mufcles, and rifes again by its own elafticity with little help ; and thefe are merely intercoftal mufcles.

Mr.

Mr. Hunter gives but an idle defcription of them along with that of the feptum, which he calls the diaphragm : But I hold it as a principle, that, although we may not fee it, yet all is orderly in the animal body ; in fact, the order of thefe cells is extremely regular : Firft, there is a membrane which comes down from the breaft-bone in a perpendicular direction till it touches the vifcera ; it runs the whole length of this common cavity of breaft and abdomen ; it enters into the great cleft of the liver, and fo divides the liver into two lobes, ferving as a liga- ment for the liver, as a mediaftinum to divide the great cavity into two, and alfo as a fort of root or bafis for the cells of either fide ; though beautifully tranfparent, it is very ftrong. At the upper end this mediaftinum touches the heart, and there expands into a very large bag exquifitely tranfparent, which is at once an air-cell and a large pericardium. Next, at its lower end, it touches the gizzard or ftomach, and forms a large cell furrounding it. Behind the liver, which fills all the upper part of this great cavity, and the gizzard which fills all the lower part, lie all the inteftines, which are alfo furrounded with many cells : at the fides the cavity is occupied by three or four large cells extending from the middle membrane to the flanks of the bird. And, laftly, when we look into thofe greater cells which are neareft the lungs, we fee clearly many openings, very large, oblique, running flat under that part of the mem- brane which braces down the lungs, fo as to communi- cate the air from the lungs to all the cells very freely.

Now let me add, in one word, that the effential parts of refpiration are thefe : Firft, there is no diaphragm, no divifion of breaft and belly, the ftomach lying upon the rectum in the pelvis ; a true and mufcular diaphragm could not exift in birds, having nothing to do in their fcheme of refpiration. Secondly, The true lungs are fmall, high in the back, quite immoveable, fo that no diaphragm nor no power of vacuum could unfold them ; and thefe lungs are perforated at every point, fo that they could not expand by air. Thirdly, What has been confounded with the true lungs is the vaft congeries of
abdominal

abdominal cells, which are of ufe only in lightening the creature that it may fly, and in forcing the air through the true lungs. Fourthly, there is in the place of a divided abdomen and thorax, with long abdominal mufcles, no proper abdomen, a long thorax, a high fternum, and very elaftic ribs, extending along the whole body till they almoft meet the pelvis, making the abdominal mufcles very fhort ; and the air-cells all along adhere to the inner furface of thefe bones.

With thefe points clearly before us, we cannot miftake the mode of refpiration in birds. The thorax does the whole ; the thorax is raifed, and immediately the cells are expanded, by which two functions are performed ; for the air which comes into the cells, paffing through the lungs, oxydates the blood, and the cells become full at the fame time fo as to make the body fpecifically lighter. The thorax is depreffed again, and the air, which paffes now a fecond time through the lungs, may a fecond time oxydate the blood, for it is not thoroughly fpoiled ; and what is fpoiled is diluted with the air of many cells, which refpiration cannot empty at one ftroke.

The final caufe alfo is plain : Had the lungs in a fowl been folid and flefhy as they are in fowls, (or even in any other creature,) and at the fame time fufficiently large to perform, without the help of thofe air-bags, all the functions of lungs, they muft have been large and heavy in proportion to the body of the fowl ; they muft have occupied much room, and added much to the weight. But the lungs of a fowl are very denfe, very fmall in proportion to its fyftem, very full of blood, quite fixed, and undilatable ; the rapid courfe of the air through them backwards and forwards enabling them in their bufinefs of oxygenation to do much with little. In fhort, there are two functions to be performed in birds : Firft, the oxydation of the blood, which is performed by the fmall, flefhy, contracted lungs, which lie immoveable in the upper part of the thorax, and through which the air blows continually

as

as through a furnace, while they are quite paffive; and, fecondly, the lightening of their bodies for flying, which is performed by the abdominal cells. It was alfo neceffary that the fternum and bony compages fhould be large in order to afford fpace for the origin and lodgement of the mufcles of the wings, and to enable them to raife the whole weight of the body in flying. The defcribing of a diaphragm, and the confounding of the abdominal cells with the true lungs, where none can be, was like to have put us all wrong *.

THIRD SPECIES OF RESPIRATION, VIZ. THAT OF
AMPHIBIA.

THIS fpecies of refpiration differs from the two firft in thefe refpects; it differs from the refpiration of Man, becaufe there is no diaphragm; it differs from that of birds, for there is no cheft covering the lungs: There is a fhort fternum, no cheft, no ribs by which the lungs may be moved, there is no vacuum formed in their re-

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* PLANS of the RESPIRATION of BIRDS.

In the firft Plan is feen—(a) The trachea dividing into branches —(b) The heart fending great pulmonic arteries to the lungs—(cc) The true lungs fhaped like the human, but exceedingly fmall, denfe, and bloody—(d) The thin and delicate membrane, which forms a mediaftinum—(e) The great air-cell, in which the heart lay—(f) The cell where the ftomach lay—(1, 2, 3, 4, 5.) A number of cells, very large, which furround all the vifcera, and fill the whole abdomen— (6, 6,) Two large cells which lie neareft the true lungs—(gg) The true lungs, which lie clofe to the back-bone. - At (ii) is feen on each fide one of the many holes by which the true lungs give out their air to the abdominal veficles. Figure 2d fhows the manner of their refpiration; for the air-vefieles are feen again (1, 2, 3,)—filling the whole abdomen. The true lungs are feen at (a)—lying clofe by the fpine, and as high as the root of the neck; and the length of the fternum and ribs, which are marked (b, c, d, &c.)—fhow that the fowl is all cheft, and that every time the cheft rifes to the line (hhh)— the veficles are dilated, and the air paffes through the lungs in the direction (i)—and every time the breaft is pulled down by the abdominal mufcles, which are marked (k)—the air is driven out again through the lungs in the direction (m),—the lungs being all the while motionlefs, and paffive merely.

fpiration;

Page 144
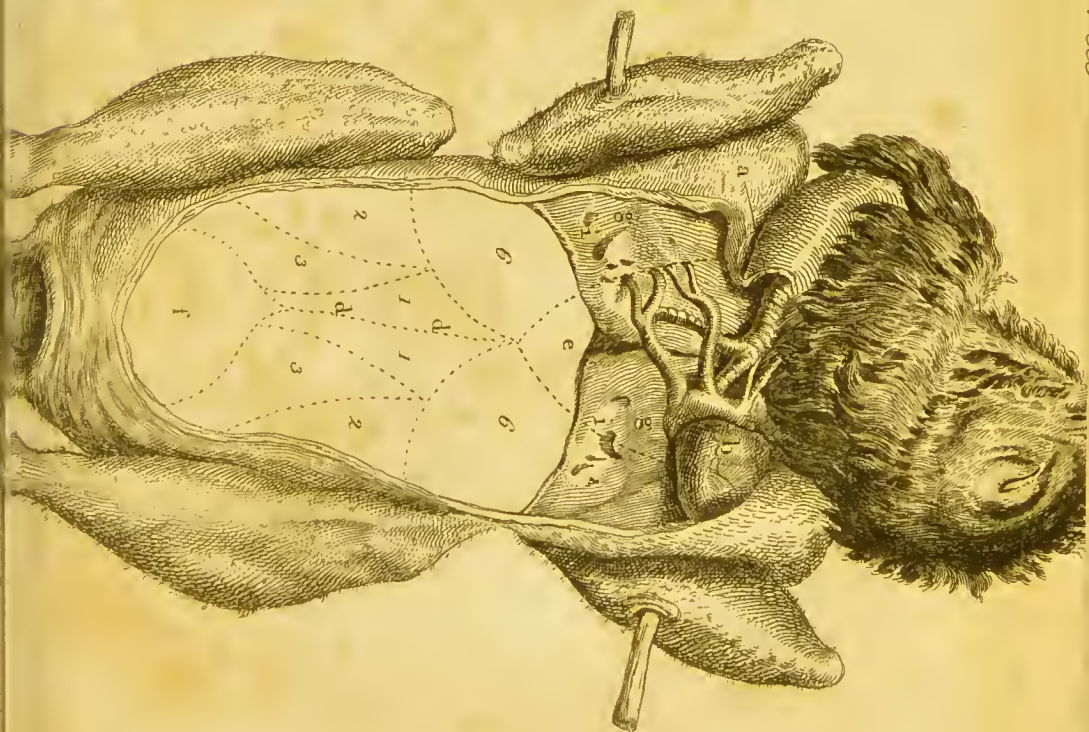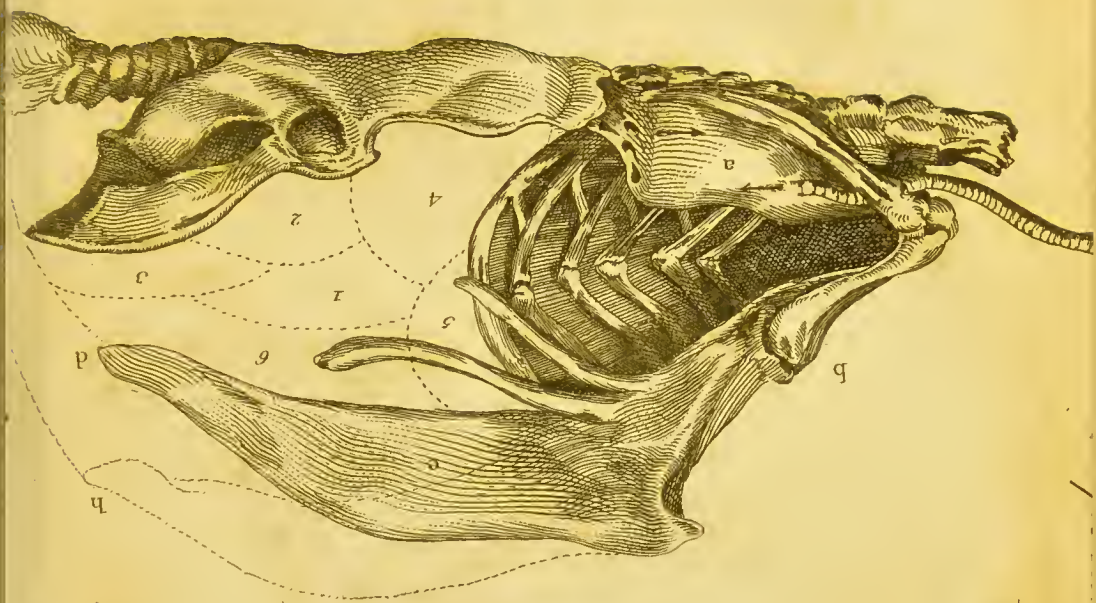
The Ostrich's Lungs
drawn by the Parisian dissectors
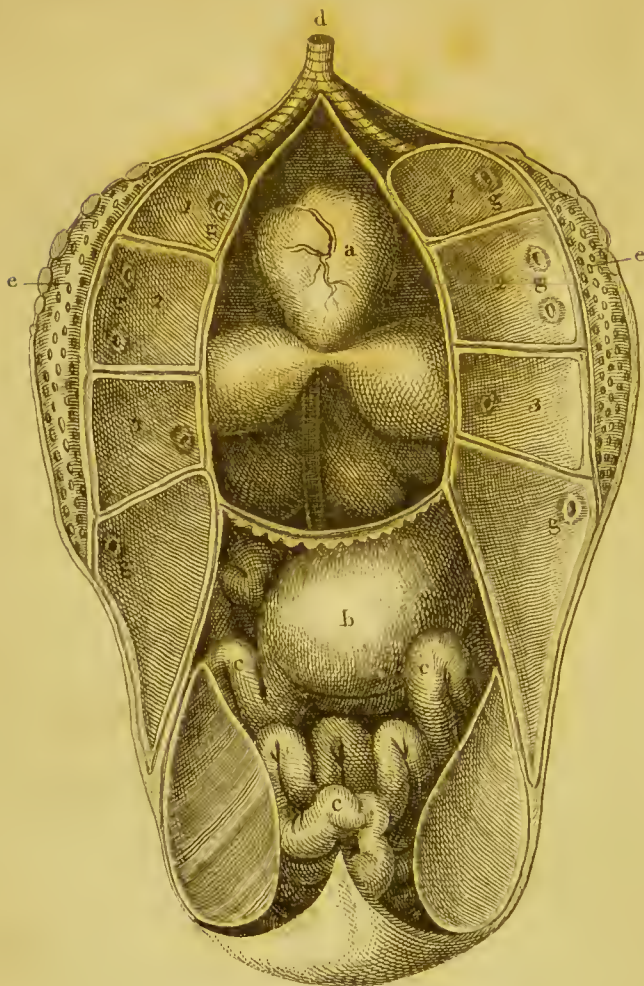
a The Heart lodged in one great Air Cell b the Stomach and
c the Intestines surrounded by other great Cells. d the trachea
branching towards the lungs. e e The true lungs firm fleshy
very small & fixed down to the backbone. 1 2 3 other great Air
Cells in immediate contact with the Lungs & communicating
with all the other Cells. the holes g g g &ᶜ are the openings by wᵗʰ
the Cells communicate with the Lungs & with one another.

fpiration; they fill the lungs by the working of their jaws, or, in other words, they fwallow their air juft as we fwallow our food.

The Frog, the Newt, the Camelion, the Tortoife, and many other creatures, breathe in this way; and as one of the moft curious mechanifms for refpiration, I fhall reprefent that of the Frog. I have placed at the beginning and end of this chapter two drawings, in which their organs of refpiration are feen; for, as I have juft explained, their organs for moving the lungs are not in the cheft, nor in the lungs themfelves, but in the throat. At (a) is feen its tongue of prodigious length; it is not like the tongue of any other creature, hinged far back in the mouth, but is fixed in the chin to increafe its length, while at the further end it is forked. We fee it launching out this monftrous tongue in catching flies; perhaps alfo with this it rakes mud. At (b), behind the root of the tongue, is the flit-like opening of the trachea; this is what is called the glottis in the human fubject. We fee this rima opening and gafping for air when we keep the mouth thus diftended; it has no epiglottis or valve to defend it; its own contraction is fufficient, for when clofed you cannot even guefs at its place; befides, the jaws force down the air into it, and the long tongue carries the food over it into the gullet. At (c) is feen the opening of the gullet, which when dilated is as wide as its jaws; it looks more like the ftomach opening directly into the throat; and this great width requires a very ftrong mufcle to contract it, and makes a great circle of rugæ. At (d) is feen the moft important part of all, the noftril of the Frog, with which it continually breathes, never opening its mouth.

Looking carelefsly upon this creature, we do not perceive that it ever breathes, for it lies plunged over the mouth in water. It is never feen to open its mouth; there is no motion in its fides like breathing; in fhort it does not feem to breathe; and when it is provoked, (or rather through fear,) though it ftill keeps its mouth clofely fhut, its fides and back rife, and it blows itfelf up apparently by fome internal power. But when
we

we obferve the creature more narrowly, we perceive
that there is a frequent motion of its jaws, or rather
of that fkinny and bag-like part of its mouth which
is under the lower jaw. We are apt now to fail into a
worfe miftake, for this bag under the jaw is alter-
nately dilated and contracted, the mouth is never opened
to take in new air; the creature feems to live all the
while upon one mouthful of air, and feems to be play-
ing it backwards and forwards betwixt its mouth and its
lungs.

But, laftly, when we obferve its noftrils, we find that
there is in the noftrils a twirling motion for each
movement of the jaws, which makes the whole procefs
perfectly fimple to our comprehenfion; for a Frog
breathes by the noftril alone, it cannot breathe by the
mouth; it never raifes its mouth above water, nor opens
it but to catch flies or other food. If you keep its
mouth open, you fee it prefently ftruggling for breath;
for its refpiration goes on in the following way: Its
broad jaws are continually fhut; they lock into each
other by grooves; the mouth is completely clofe, and
forms a fort of bellows, of which the noftrils are the air-
holes, and the mufcles of the jaws which come from
the os hyoides draw in the draught by their alternate
contraction and relaxation; and the noftrils lie fo obli-
quely over the hole in the fkull, which is reprefented at
(a) in the Plate at the end of this chapter, that the leaft
motion of them enables them to perform the office of a
valve. Firft there is a twirl of the noftril which lets in
the air; then a dilatation of the bag under the jaws, by
which the mouth is greatly enlarged and filled with air;
then a fecond motion of that bag, by which the mouth
is emptied and the lungs filled; then there is a flight
motion of the fides of the creature, by which the muf-
cles of the abdomen expel the air again; and then the
twirl of the noftril and the motion of the jaw fucceeds
again; fo that with thefe creatures infpiration is the fwal-
lowing of the air by their broad expanded jaws, with
their coverings driving it down into the lungs; and ex-
piration is the contraction of the abdominal mufcles
driving

driving it out again : and thefe two motions, when we obferve a Frog attentively are as perfectly regular as refpiration in a Man. Their mufcles of refpiration are not the mufcles of the belly but the mufcles of the jaws ; and this caufes the uncouth broadnefs of the jaws in Frogs, Newts, Lizards, Serpents, Turtles, &c.

a the Nostrils — b the Tongue

Now we fhall no longer wonder why the Frog never opens its mouth ; why it never feems to breathe ; why, after opening its belly, the lungs ftill project ; why, after emptying its lungs, it can fill them again at will, not by any peculiar power in the lungs, but by blowing them up with its jaws. If you gag the Frog and keep its mouth open, it cannot fill them, becaufe it cannot breathe ; if you plug its noftrils, it fuffocates, though not foon; if you keep its mouth open by force, you foon find it ftruggling for breath ; and looking into its throat, you fee the glottis opening from time to time *.

The Newt (or as it is called in this country, the Afk) breathes with the jaws and noftril like the Frog ; it has, like the Frog, a conftant motion by fhort ftrokes of the bag under the jaw (which bag is formed by the membranes of the mouth, covered and moved by the genio-hyoidei and mylo-hyoidei mufcles) , but we obferve that every minute, or lefs, it ftops as if intending fome particular motion ; then gradually the bag fwells out under

* Dr. Monro, in his explanation of Plate 16. fhows us very obligingly the diaphragm of a Frog, marked (c).—This diaphragm is mentioned a fecond time in explaining the fame Plate.

the

the lower jaw to a great 'fize; then the air contained in it
is puffed down into the lungs with a fudden flap of the
bag; and in proportion as the jaws are emptied the long
fides of the creature are heaved up.

The Toad, the Camelion, the Green Lizard, breathe
exactly in the fame way. The Camelion has the flat
broad jaws of the Frog; they lock into each other, and
it does not open its mouth in refpiration; it fwallows its
air in mouthfuls, drives it downwards into its lungs; its
lungs are of a vaft extent, ftretching from the jaws all
along the abdomen: it is the vaft fize of its lungs, al-
moft concealing the abdominal vifcera, that makes Gef-
ner fay, " that of the entrails of a Camelion the lungs
only are vifible." The air it fwallows in greater or
fmaller quantity as its needs or fears prompt it. When
you alarm this timorous animal, it fills its fides juft as
a Frog fwells out its back; and either in this greater
refpiration, or in its ordinary breathing, we fee it preffing
the air onwards from cell to cell; and we fee the mo-
tion proceeding from its jaws to its breaft, and all along
its fides, till its lank form is quite puffed up almoft to
burfting.

All thefe creatures have, in addition to their peculiar
refpiration, a peculiar kind of lungs, thin, membranous,
and extremely delicate: the lungs even of fo great an
animal as the Crocodile are, when inflated, very delicate
and tranfparent, of a rofe colour or flight red, confifting
of delicate veficles, and exactly like the Frog's lungs.
The lungs of the Frog are in fhape like a fir-cone,
with the ftalk of the cone on each fide fixed to the fide
of the heart. But thefe conical lungs of each fide are
delicate, filvery, perfectly tranfparent, divided within
into innumerable cells like a honeycomb; and thefe alfo
are fo extremely delicate, that though the outfide mem-
brane is as tranfparent as a foap-bubble, the divifions
can hardly be feen, except by inflating and drying the
lungs, and then cutting them. The lungs of the Afk
are ftill more beautiful, as a fpecimen of what are called
membranous lungs; for the creature is very long in
the body, its lungs run down along all its fides; they
are

Neut

Frog
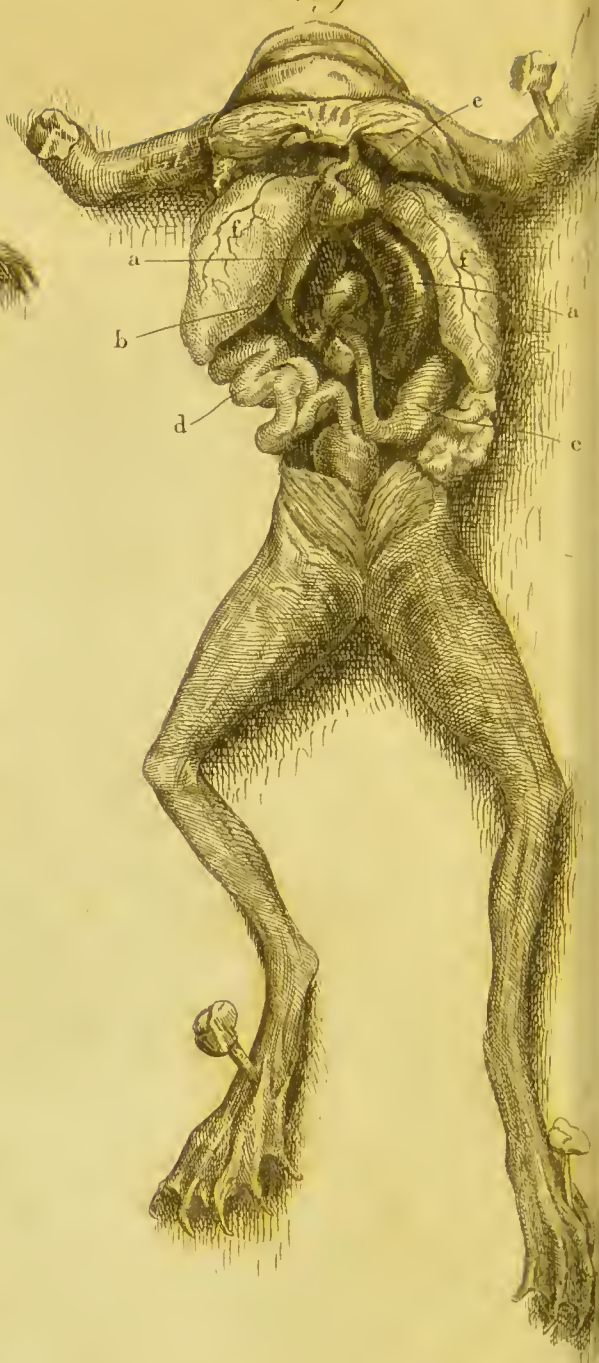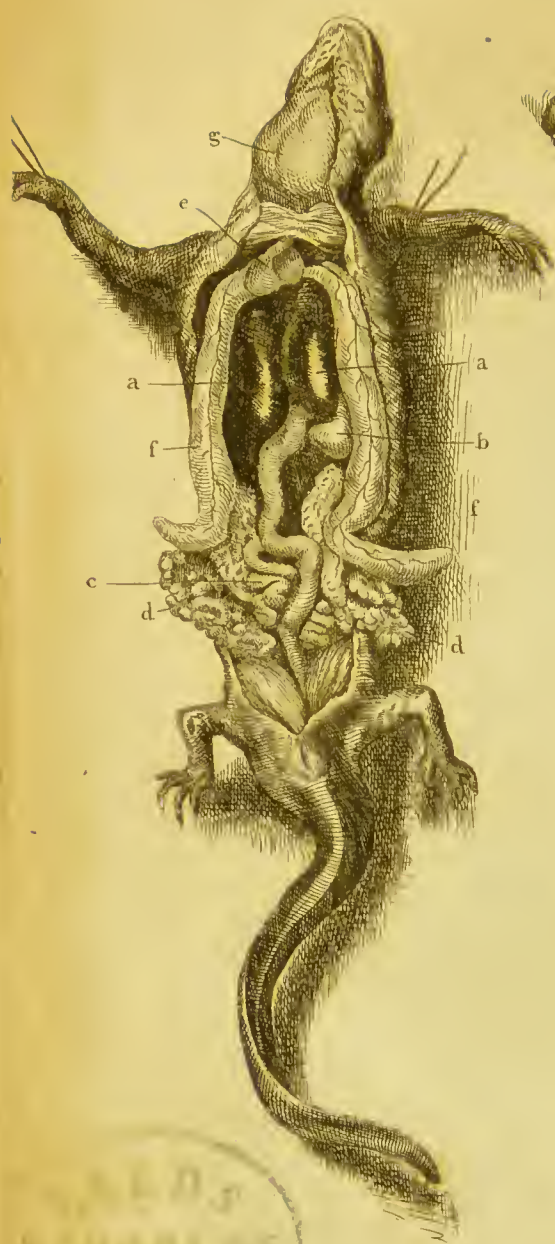
In the Frog aa is the Liver b the Spleen c the Stomach
d the Intestines e the Heart ff its conical vesicular Lungs
In the Neut a the Liver b the Stomach c the Intestines
d Ova in the Ovaria or Egg-beds e the Heart ff Then vesi-
-cular Lungs which are long like Intestines & transparent
like the swimming bladder of a Fish g the Bag of the
Jaws by which the lungs are blown up

are about the fize of a common earth-worm or writing quill; they end like a blind gut; they are of a bluifh-white, exquifitely tranfparent, like the fwimming bladder of a fifh.

It is the nature of membranous lungs to oxygenate but a very fmall quantity of blood; they are membra-nous, only becaufe there is not that vaft profufion of arteries, veins, and ftrong veficles, which there is in the human lungs. The pulmonic artery and vein are al-ways, in the membranous lungs, extremely fmall in pro-portion to the vaft fyftem which they ferve. There can-not be better examples of this fact than thefe two draw-ings of a Frog and of a Newt: In the Frog is feen the fmall artery and vein fpreading more fuddenly over the lungs; in the Newt is feen the fame artery and vein, running down more directly, and for a greater length along its lungs: in both we fee the artery to be little bigger than the ranular arteries of the Frog's tongue at the head of the chapter. The manner of its coming off from the aorta is feen in the firft plan in the book, where figure 2. reprefents truly the Frog's heart; and there we may obferve how fmall a proportion the pulmonic artery bears to the reft of the arterial fyftem.

From thefe peculiarities of the membranous lungs, it is plain that the oxydation of the blood is a procefs of fmall importance in their fyftem; that this procefs being of little value with them, they are the better enabled to go into the water, and to want breath for a time. But chiefly it appears, that the meaning of this peculiarity is not fo much to give them the privilege of Amphibiæ, in allowing them to go into the water; for many creatures, as the Camelion, all the tribe of Lizards, Newts, Toads, Serpents, &c. have thefe lungs, and yet never approach the water: but that the chief ufe of it is to eftablifh in this clafs of animals a peculiar conftitution, a permanent, almoft inexhauftible, irritabi-lity, and a tenacioufnefs of life; which, I believe, no creature, whether of the land or the water, wants, which has membranous lungs. And when we are told that thefe creatures can be kept two days under water,

as

as a proof of their being Amphibiæ, I cannot but con-
fider it as a very childifh proof; for, in the firft place,
we fee them breathing with wonderful regularity when
out of the water; when plunged into the water, we fee
them very foon ftruggling for breath, and if they can
live for two days without air, it is only becaufe they
could bear any other kind of injury with equal eafe, and
could live two days without their heart or their head.

FOURTH SPECIES OF RESPIRATION, VIZ. THAT OF
FISHES.

In this fpecies of refpiration the creature breathes
neither water nor air, but water mixed with air, and
this office is performed by gills in place of lungs.

The reafon why I have called this a fpecies of refpira-
tion, needs to be very fully explained; for, though
little obferved, it is a certain fact, that a creature, with-
out any apparent change upon its fyftem, can do well,
having its blood oxygenated at one time by gills, at
another time by lungs. The Frog, for example, lives
long in the water; while it does fo, it may be confi-
dered as a fœtus which cannot breathe: the young Frog
which has not yet acquired its proper and natural refpira-
tion, breathes like a fifh. For the firft fourteen days
after hatching from the egg, and while the Tadpole is
very fmall, it has gills, which are two long, projecting,
fimbriated appendages like fins; by the thirty-fixth day
thefe appendages are taken into the jaws, and form four
rows of gills on each fide, regular, and like thofe of a
fifh; but at the fame time, this fœtus has its lungs
within the body, not to be ufed till it come out into the
air, when the lungs affume their function and the gills
fhrink. The fame fyftem in this inftance, which was
at firft ferved by gills, is in the end oxygenated by
lungs.

The motion of the gills in fifhes is a true and perfect
refpiration: for, in the firft place, if there be no air in
the water, or not enough of air, they cannot breathe;
diftilled water is to a fifh what the vacuum of an air-
pump.

pump is to a breathing creature : if you exhauft water with an air-pump, if you boil it, if you diftil it, if in any way you deprive it of its air, fifhes cannot breathe in it, but come up to the furface and gafp for air. If you take a fifh out into the air, it is the fame with plunging any breathing creature into water, it gafps and dies. Fifhes cannot breathe in air wanting water, for that element is not accommodated to their fpecies of lungs ; nor in water wanting air, for then there is no oxygene ; and we find, upon extracting the air from water which fifhes have breathed, that it is contaminated, exactly in the fame way with air which had been breathed by any breathing animal, and that it differs very little from that in which a candle has burnt out. This is the reafon that when many fmall fifhes are inclofed in a narrow glafs, they all ftruggle for the uppermoft place, and that when in winter a fifh-pond is entirely frozen over, you muft break holes for the fifhes, not that they may come and feed, but that they may come and breathe ; without this, if the pond be fmall, they muft die.

In the refpiration of fifhes, there are two curious points to be confidered : Firft, The manner in which their refpiration is performed ; and, fecondly, The manner in which their blood, when thus oxydated, is diftributed over the body.

The red part or gills, which ferve as lungs, lie under a broad fcale, which defends them from all extraneous bodies, or hurt, or preffure of any kind, for they are exquifitely delicate. Their refpiration is like the Frog's in this refpect, that they fwallow the water with their mouths ; and in this it is like the fowls, that they drive it through among their gills, which lie perfectly paffive like the true lungs of a fowl.

A fifh's gills are ranged in femicircles under the great flap which covers them four or five femicircles on each fide ; the fifh opens its mouth wide, fills it with water, fhuts the mouth, then drives the water backwards, fo that it lifts the great flap and makes its way out behind, and rufhes with a fort of ftream through among the red gills, raifing each femicircle from another, and making

the water play freely round each feathery-like procefs.
It feems to me, that wherever this mixture of water and
air is ufed, there muft be fome force to give impreffion
to the air. upon the blood. The depth to which fifhes
go, and the preffure of the water, muft give fome effect
in impreffing the air upon the lungs. The gill muft play
more or lefs ftrongly according to various depths, juft as
the fifh muft fwim more ftrongly againft a ruder ftream.
Some fifhes, as the Trout, Perch, Salmon, Herring,
have more open gills, yet they do not want this power
of impreffing the air more or lefs ftrongly againft the
gills. The Eel and
the flat fifhes, as the
Skate, have their
gills more concealed.
They fwallow the air
by the mouth, and
breathe it out by holes
in their fide. The fhell-
fifhes give the moft
curious example (and
none more fingular
than the oyfter) of
very regular and beau-
tiful gills; and there-
fore I have given two
flight marginal draw-
ings; the firft of
which fhows the heart
and lungs at (a).—
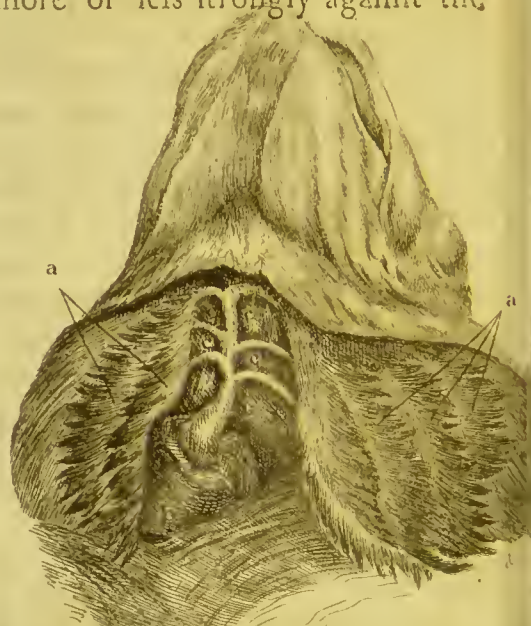
a,a. *Gills of a Trout* — b *Its Heart*
c,c. *the Arteries of the Gills*

The heart, which may be feen beating about 40 in a
minute at (b)—The whole of the gills as they lie out
upon the fide of the Oyfter, and bear a' very large pro-
portion to its body. The canal is—partly opened, in
which the water paffes to the gills from the mouth (d)
—And at (e, figure 2.) is feen, feparated from the
body, a long canal opened; before it was laid open, it
was fomewhat of a triangular figure within; it confti-
tutes the bafis of all the circles of gills; it contains the
moft beautiful ranges of holes that can be feen in nature,
                                                        by

by which, as is very plain, the water is admitted to each feather of each gill. The fish swallows the water by its mouth, which is at (*d*, figure 1.)—drives it down into this great canal, and so out again. It is by this, I am persuaded, that merely the soaking of a fish's gills in water would not do, for they might have lain abroad, as indeed they do, and soaked very securely in a shell-fish; but the water must be applied with a degree of force proportioned to the condition of the lungs, or the needs of the system; and every fish, whatever be the mechanism of its respiration, has this power.
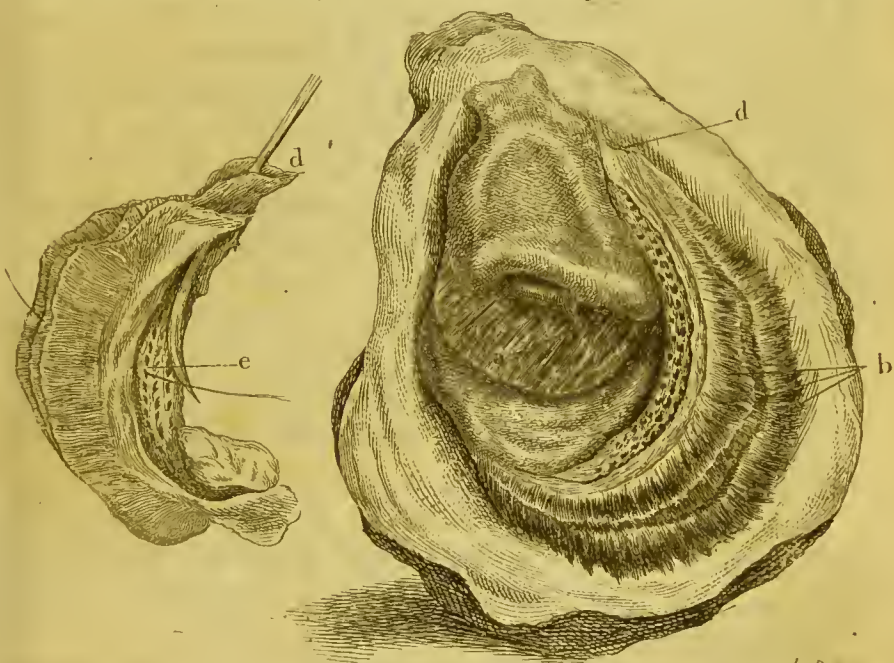
Having explained this first point, viz. the mechanism of their gills, I proceed next to explain the circulation of their blood, how their blood is oxydated, and how it is distributed over the body.

A fish and an amphibious animal have both of them the simple heart, consisting of one auricle and ventricle, but with this singular variety, that the Frog, for example, wants the heart belonging to the lungs, a small artery only from the common system performing the office; while the fish again wants the heart, which should circulate the blood through the body, and has that heart

only

only which belongs to the lungs. The whole blood of the fifh paffes through this fingle heart, and therefore the whole mafs circulates, parcel by parcel, through the gills, for every time that it circulates through the body. We fhall begin its circulation, then at the heart. Firft, The whole blood of the body is returned into the heart of a Skate, by two great veins. Thefe two great veins deliver it into a vaft auricle, or refervoir rather, which lies over the heart. The auric'e delivers it into a ftrong ventricle, whofe action is further ftrengthened by the action of its aorta, which from the heart up to where the valves are, is very mufcular and powerful, and con-ftitutes, in a manner, a part of the heart. But this great veffel muft in this fpecies of circulation change its name, for it really is not an aorta, has nothing to do with the body: both the heart of a fifh, and this its only veffel, belong entirely to the lungs or gills, and as thefe are called bronchiæ, this is the bronchial artery. The gills of this fifh are five in number on each fide, and on each fide the bronchial artery gives out two branches which ferve the five gills; the lower branch is large, and ferves the three lower gills; the higher branch, which goes off like one of the arms of a crofs, ferves the two upper gills.

Secondly, Thefe arteries being diftributed along the gills, divide into exquifitely fmall branches producing that feathery appearance which is fo beautiful. Thofe minute fubdivifions of the bronchial veffels expofe the blood to the air. This may explain to us how in the human lungs the expofing of the blood, even with the interpofition of membranes and of the arterial coats, may be fufficient for the oxydation of the blood. All the blood thus oxygenated is returned by veins, corre-fponding exactly in number and arrangement with their arteries; and the heart being turned afide, and all the other vifcera taken out, the veins are feen accompanying their arteries and emerging from the gills. to form the aorta.

Thirdly, the aorta is formed by the veins of the gills, and the veins of the gills lie clofe upon the fkull of the fifh,

fifh, and the aorta upon the back-bone; and this veffel is in one fenfe a vein, fince it is a continuation of thofe veins which return the blood of the gills; but both in office and form it is a true aorta; in office, becaufe it diftributes blood to the whole body; and in form, be- caufe it no fooner fwells out into the fhape of an aorta than its coats grow hard, ftrong, mufcular, fit for its office, while thofe of the veins from which it is formed are pellucid, delicate, and very tender. The aorta is full of the oxydated blood of the gills; and although, by the delicate circulation of the gills, it has loft all communication with the heart, it circulates this oxydated blood through the body to all the mufcles, glands, vifcera, &c. without the intervention of a new heart.

The veins which return the blood of this aorta are the ordinary veins; they arrive in two great branches at the heart, and need not be further explained.

I will not be at the trouble to repeat the tedious cal- culations of authors concerning the immenfe furface which the gills expofe: Let the ftudent look to the gills, and he will prefently, with the help of this fhort fketch, underftand how the whole function goes on.

N.º 1

Stigmata

FIFTH SPECIES OF RESPIRATION, ### VIZ. THAT OF INSECTS.

There is in this kind of refpiration no breathing organ like the lungs, but tracheas or air-tubes by which air enters into all parts of their body.

What

What is moſt perplexing in this ſpecies of reſpiration is the prodigious quantity of air which theſe creatures receive; the little connection betwixt the air-tubes and the heart; the impoſſibility of tracing blood-veſſels from the heart to the various parts to nouriſh them; and the clearneſs with which we ſee their air-tubes branching over all parts of their body. The ſtomach, bowels, and other viſcera, the legs and wings, even the very ſcales of inſects, have branches of the air-tubes dividing over their ſurfaces like the delicate veſſels of leaves and flowers. In ſhort, the magnitude of theſe air-tubes is quite ſurpriſing; and their branchings are ſo minute, delicate, univerſal over all the body, that it looks almoſt as if the air-tube had exchanged functions with the heart and arteries.

It is plain by theſe expreſſions of admiration that I do not mean to attempt ſo difficult a ſubject as this at preſent: I only mention difficulties which it is ſurpriſing that others have not declared and inveſtigated, for nothing can be more intereſting. The little that we do know ſhall be ſimply and plainly told.

The forms of inſects are often very ſtrange, their lives very irregular, ſometimes in water, ſometimes in air; many of them begin in worms, and end their lives as Flies and Moths; and according to theſe varieties of their form, or life, or generation, their air-tubes are various.

Sometimes, as in the common Bee, they have nearly the form of lungs: They begin like two bags, reſembling thoſe of the Alga Marina, or ſea-weed, in ſhape; and theſe bags diſtribute pulmonary tubes, with occaſional bag-like dilatations in the courſe of the tubes, through all the body. More commonly the air-tubes of inſects are direct tubes, mere tracheas, of a very ſingular conſtruction; they have rings like the tracheas of animals; they have a delicate membrane covering theſe rings and forming them into a tube: the tube continues always rigid like a flexible catheter, or other tube of twiſted wire not liable to collapſe: They begin by many open mouths opening along the ſides of the inſect, and
they

they terminate in myriads of veſſels, which, in their forms and progreſs over the various parts of the body, reſemble blood-veſſels more than it is eaſy to conceive. Theſe air-tubes being thus rigid, are always full of air, and by their refractions through the tranſparent parts of the inſect's body they give it in the microſcope a great degree of brilliancy ; as for example in the Louſe, whoſe air-tubes make the brilliant lines and points which are contraſted like a ſilvery colour with the dark and opaque parts ; or in the Mite, which is as beautiful in the microſcope as the Louſe ; and when the larger inſects are prepared by drying and varniſhing, and preſerved in turpentine, the air-tubes are beautiful. Of theſe curious particulars, the openings of the air tubes are beſt ſeen in the Worm from which the common Butterfly is produced ; we count theſe holes down the ſides, we name them puncta reſpiratoria, ſpi-racula, or moſt commonly ſtigmata ; (Vide figure 1.) Their tranſparency and brilliancy is well underſtood from the view of the microſcope Louſe, (figure 2.)

That particular form in which they reſemble more the lungs of animals is ſeen in the pulmonic bags (*aa*)—and the tracheas or air-tubes (*bb*)—of the common Bee, (figure 3.) Their exquiſite branchings through the various parts are well ſeen in the drawing of the air-tubes which run along the wings of a Bee (figure 4.) or thoſe which twiſt and ramify round the inteſtines and

ſtomach

Air Tubes

J.R.A.

ftomach of a Worm ; and it is not to be forgotten, that though the beginnings of thefe tubes in their great tracheas and near the puncta refpiratoria are quite tranfparent, their extreme branches are beautifully white like veffels filled with chyle, or rather one might be apt to miftake them for nerves.

Fig. 3   *Fig. 4*
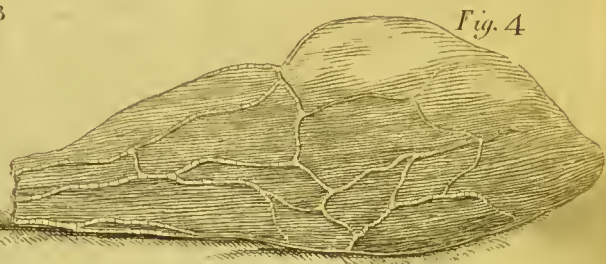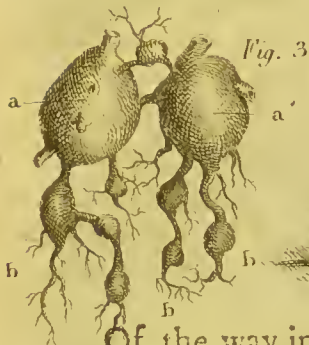
Of the way in which this function is performed, there muft be more varieties that we can know or comprehend : this we may fafely conclude from the little that we do know, finding the variety fo very great.

Almoft all infects have their puncta, like thofe of the Caterpillar, ranged along the fide, and inofculating like thofe of the Loufe from branch to branch : often the puncta open along the fides ; but in place of inofculating from branch to branch, all round one fide, they inofculate acrofs the belly, the one fide communicating with the other. This is beft obferved in the fmall Worm from which the Bee proceeds (vide Fig. 6.), which is a magnified drawing of the Bee-worm. And here it muft be obferved, that, as in other infects, always the ftigmata or breathing points correfpond neatly with the folds or rings while it continues a Worm, and with the fcales or divifions of the body when it becomes a Fly ; in the Bee-worm alfo the inofculations anfwer to the flexures or joints of the body.

Often when the infect lives in water, it has only two puncta refpiratoria : thefe puncta begin either in the fnout or in the tail ; they are the openings of two great air-tubes which run down each fide of the infect like two aortas, and the infect has means of rifing to the furface, takes down a bubble of air along with it, and difcharges a bubble of air before it rifes again : of this nature are

the

the air-tubes of that Worm from which the Ephemeris proceeds. The sketch of the Ephemeris and its air-tubes is given in figure 7.—This Fly has but two spiracula; they are so small towards the neck, where their commencement is, that their mouths cannot be easily found. The two great air-tubes (*aa*) are seen like two aortas running all along the body, and their minuter branches (*bb*) are seen ramifying beautifully upon the abdominal muscles and other parts. Many insects are aquatic when first they are hatched from the egg. They have little gills which serve them while they continue in the water, as, for example, the Ephemeris Fly; but along with these gills they have the ordinary structure of air-tubes, and the day on which they emerge from the water, the gills shrink, and the air-tubes begin their function; and these changes succeed each other very rapidly in all insects, but most especially in the Ephemeris, which is destined to live but one day.

It is most of all singular, that in some insects the number of respiratory points, or puncta, changes according to the various conditions or stages of their existence. For example, a Worm which crawls among the dust, since it must breathe less easily, has more puncta than when it has changed its state to that of a Fly, and has its puncta very freely exposed to the air: in the Rhinoceros Beetle the Worm has more puncta respiratoria, and closer, because it crawls on the ground amidst mud or dust; they are less numerous in the Fly, as its air-holes are always more freely exposed; and when the Beetle is actually flying, those puncta which were closed by the cases of the wings are fully opened; so that the insect breathes more freely, and perhaps its body is lightened, so that it flies more easily: it is also particular, that in the full-grown Beetle, though the puncta be less in number, the lungs are enlarged, they both change their form and become more capacious; for the tubes are mere tracheas or straight lines, with direct branches in the Worm, but in the Beetle they are dilated from point to point into air-bags.

Insects in general are bred in eggs, transformed into worms;

worms, affume then the form of an aurelia, that is, of
a Fly, fmall but full formed, with its legs drawn up, its
wings plaited and folded, ready at all points to burſt
from the covering which furrounds it ; for both in pof-
ture and in the membranes which furround it, it re-
fembles a fœtus. In thefe three ſtages it ſtill is nouriſhed
by air-tubes : they open by puncta refpiratoria while it
remains a Worm ; the fame puncta ſtill ferve it while it
is wrapped up an aurelia or concealed Fly ; when the
Fly burſts out, the fame puncta, the fame tubes, which
have ferved in its former ſtages, ferve it ſtill ; only this
is moſt curious, that when from a Worm it proceeds a
Fly, the ſkin which it rids itſelf of (crawling out of it
and puſhing with its feet) carries off along with it many
of the internal parts ; the mouth, the anus, and efpeci-
ally all the refpiratory tubes, lofe an internal ſkin, at the
fame time that the old ſkin or flough is puſhed off from
the outward furface of the body ; and when the puncta
are thus changed, they are left more open than before,
and often their number is changed. For the drawing of
this flough or ſkin (*a*)—from which the Worm has juſt
difengaged itſelf, and the old air-tubes (*b*)—inverted, and
adhering to the caſt ſkin, fee figure 8. which is the figure
of the Coffus, an affected name by which Mouffet and
others have chofen to diſtinguiſh the Worm from which
the Horned Beetle proceeds.

These are the various ways by which infects are fup-
plied with air ; and nothing can be more intereſting· than
to obferve the vaſt proportion of air which they draw in,
which is certainly a provifion for their living in places
where oxygene cannot be plentifully fupplied. And the
fact is well known, that infects can live on air much lefs
pure than what is neceſſary to breathing creatures, and
that they exhauſt the oxygene of the atmofphere much
more completely than any other living creature. The
variety in the manner of conducting the air to the fyf-
tem of infects is changed, and fuited, as I have obferved,
to their various ways of life, and to the various condi-
tions and ſtages of their life ; while they are Worms,
when they are involved fœtufes, and when they have
                                                            burſt

burft their fheli and are full grown. In fhort, Worms,
Aureliæ, Flies, Beetles, Bees, and all forms of infects,
have all of them their tracheas by which they breathe a
wonderfully large proportion of air.

Fig. 8

Fig. 7

Fig. 6

Cofsus
Fig. 8

Bee Worm

Ephemeris
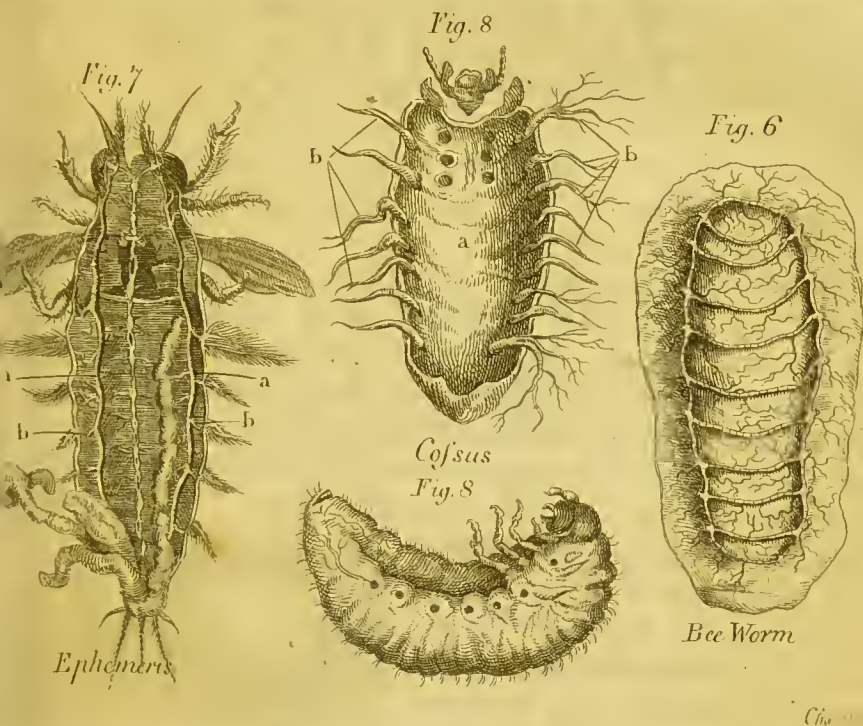
There can be no miftake concerning the function of
their air-tubes and of their heart ; it is ignorance or in-
attention only that can caufe confufion ; the heart of a
Caterpillar, of a Snail, of the Worms from which va-
rious Flies are produced, are feen diftinctly through
their tranfparent body, running down their back in form
of a tube, fometimes flightly oval, fometimes having fre-
quent dilatations, and throbbing, though with lefs equable
and diftinct pulfes than in the more perfect animals.

Nor can there be any miftake that it is air they
breathe ; for before we diffect an infect, we muft kill it;
the contortions of a live Caterpillar prevent all deliberate
diffection, or even a view of the parts ; we may poifon
the infect, as with turpentine or fpirits ; we commonly
drown it : this is done by immerfing it in a little tepid
water.

water. Nay, we find a thing which is at firft incon-
ceivable to be really true, that notwithftanding the inof-
culations of the air-tubes with each other, which feems
to provide againft all fuch effects, when we clofe up the
ftigmata of an infect one by one, the parts become in
the fame proportion paralytic; if we varnifh over the
ftigmata of one fide, that fide becomes paralytic; if
we varnifh over the ftigmata of both fides up to the laft
holes, the infect lives, but in a very languid condition,
it furvives in a kind of lethargic ftate for two days, with-
out any pulfation in its heart; if we alfo ftop the two
higheft holes, it dies.

Of all the examples of refpiration, that which is re-
ported by Spallanzani is what I moft wonder at, and
cannot but doubt. In acefcent liquors, or the juices
of animal bodies, animalcules are feen plainly with fim-
ple glaffes, moving fometimes rapidly, fometimes flowly;
but never hitherto has any author pretended to fee their
lungs or heart. Mr. Spallanzani fays, " that thefe
animalcules are elliptic bodies;
that in the centre of each ellip-
fis he fees two ftars, which are
in conftant alternate and regular
motion, whether the creature

refts or moves. Each ftar-like body has in its centre a
fmall globe, and every three or four feconds the globules
are blown up flowly to three or four times their natural
fize, and as flowly compreffed again; and every time
that the radii are inflated the central globule fubfides.
On one fide of thefe ftar-like bodies there is an oval part,
which is continually agitated with a trembling motion;
he calls the ftar-like bodies lungs, and the oval body he
thinks is the heart." Spallanzani furely has forgotten
that he is fpeaking of lungs in an aquatic infect: if thefe
ftar-like bodies have any fuch ufe, they muft be gills.

Thefe are the animalcules which Buffon called or-
ganic germs, and from which, as materials and pieces,
he built up the animal body. But if all this be true,
then the day is come which he little expected, when
the organic particles, on the faith of which he built all
<div align="right">his</div>
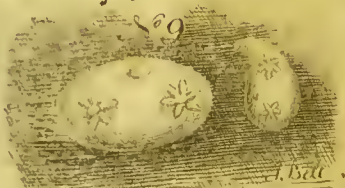
Plans of the Diaphragm

No.1
Shewing the Place and Form of the Diaphragm

No.2
Shewing the Effects of its descending
& ascending alternately
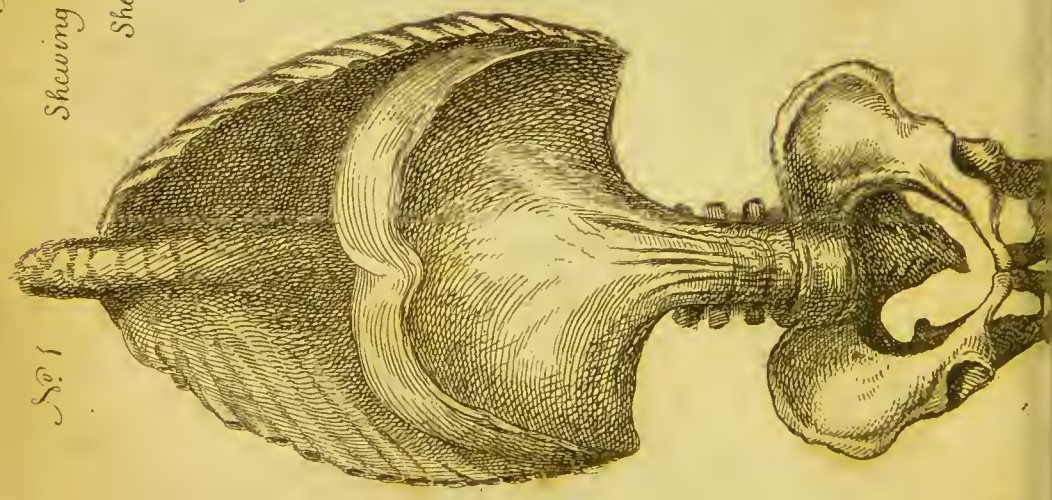
Expiration

Inspiration

No.1
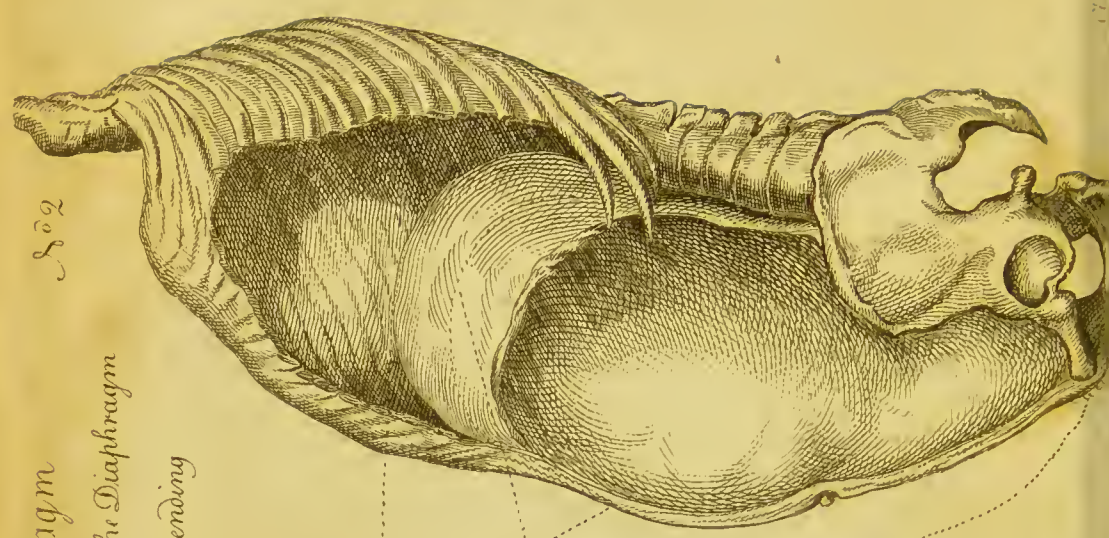
his fyftem of generation, are proved to be living and moving animalcules, voracious of food, devouring each other, breathing air, and having a vifible pulfating heart; animalcules depofited from the atmofphere, and generating like other infects of their kind.

Thus we are convinced of the importance of refpiration, and the abforption of air in all living creatures, from Man even to the meaneft reptile; and not le ft needful in the laft and loweft order, which receive in proportion a fuller fupply of air than fifhes, amphibiæ or Man.

CHAP. IV.

OF THE PECULIARITIES IN THE CIRCULATION OF THE FŒTUS.

THE peculiarities of the fœtus all relate to the oxydation of the blood, and are fuch chiefly as fulfil the circulation of the blood without any need of its paffing through the lungs, enabling the fœtus to live without that function in its mother's womb.

1. We are affured that the blood which comes to the fœtus through the umbilical vein is pure, or of greater value than that which the fœtus returns to the mother's fyftem. Either this blood is reftored to all its properties merely by paffing through the mother's fyftem, and what is thus drained off from the extremities of the mother's fyftem is more than fufficient for the life of the child; or, without fuch direct communication, the placenta performs to the fœtus a function equivalent to that of the lungs. Then this blood, whofe value and properties muft be loft, if pufhed through the circulation of the liver, paffes only in part through the liver, while a chief fhare of it goes by a fide paffage, which is called the DUCTUS or CANALIS VENOSUS, under the liver, directly to the heart *.

* *N. B.* The canalis venofus is marked in the plan.

2. This

2. This blood does not pafs through the circulation of the lungs; perhaps it ought not to pafs; for there being no refpiration, no air admitted to the lungs, the blood might rather be contaminated; perhaps it cannot pafs, the lungs never having been expanded with air: but, however that be, there is a fide paffage for conveying it from the right to the left fide of the heart clear of the lungs. For this ufe is the FORAMEN OVALE, which is an opening of no inconfiderable fize betwixt the right and left auricle of the heart; its area is as large as that of the vena cava; and it is fufficient, without the help of the ductus arteriofus, to convey the blood freely from right to left.

3. The DUCTUS ARTERIOSUS ferves quite another purpofe; for though the circulation of the aorta is well maintained in the adult body by the force of one ventricle only, yet in the fœtus one ventricle will not fuffice. In the fœtus the heart muft pufh its blood not only through that fyftem of veffels which is within the body, but alfo it muft pufh it onwards through a fecond circle of veffels, viz. thofe of the placenta; for the iliac arteries do not defcend into the thigh and pelvis of the fœtus, but the iliac artery itfelf, with little diminution (very fmall branches only being given downwards into the pelvis and thigh), turns upwards along the fide of the bladder; and thefe two arteries going out from the navel, form the umbilical cord; and the heart of the fœtus has to give life and action not only to its own internal fyftem, but to thefe two arteries comprehending the chief bulk of the aorta, which run out to the diftance of three feet along the umbilical cord, and which make wonderful convolutions in the placenta, and terminate with extreme minutenefs upon its furface. It is this which occafions the neceffity of the ductus arteriofus, which is merely a union or inofculation of the pulmonic artery with the aorta. This union is formed by a great branch of the pulmonic artery in the fœtus, joining the aorta below its curve. This great branch (for it is greater than the two branches which go to the lungs) is named the ductus arteriofus, and may be defined an in-
ofculation

ofculation betwixt the pulmonic artery and the aorta,
fo very large, that it gives the aorta of the fœtus twice
its natural fize and proportion, and enables the blood
of that artery to have the full force of both ventricles;
of the left ventricle through the aorta, and of the right
ventricle through the ductus arteriofus by one fynchro-
nous ftroke.

4. The contaminated blood of the fœtus muft be re-
turned to the mother, or at leaft to the placenta; for
which purpofe the two iliac arteries are reflected along
the fide of the bladder as I have juft explained. I fay
the iliac arteries without referve, becaufe the hypo-
gaftric and femoral arteries, that is, the arteries of the
pelvis and thigh, though they are the largeft branches
of all the body in the adult, are in the fœtus extremely
fmall; and thence that fmallnefs of the lower extremi-
ties compared with the largenefs of the head, which
characterizes the child, and which it takes years to
redrefs.

DUCTUS VENOSUS.

Thus have I defined thefe parts and their ufes, in
order that their ftrict anatomy may be the more eafily
explained; and the part firft mentioned, viz. the ductus
venofus, is the part the moft dificult to be underftood,
and never without the help of a plan. In my plan I
have endeavoured to elucidate thefe points.

Firft, the mere anatomy, connections, and inofcula-
tions of the veffels; fhowing how the umbilical vein
brings in the blood of the mother; how that vein fpreads
in the liver and feeds all its left fide with blood; and
how the ductus venofus carries part of that blood away
from the circulation of the liver, conducting it directly
onwards to the right fide of the heart.

Secondly, I have endeavoured to explain what parts
of the liver each branch fupplies, and how thefe veffels
lie in the liver of a new-born child.

Thirdly, I have contrafted with this the change of
form in thefe fame veffels, when, as happens in the
adult, the form of the liver is changed, and the ductus

I

venofus

venofus and the umbilical vein are obliterated, and gone, or converted into ligaments of very trivial ufe or fize.

The blood from the maternal fyftem tranfmitted through the placenta, and oxydated, or having undergone fome change equivalent to oxydation, comes down along the umbilical vein:—the vein enters by the navel, adheres to the inner furface of the abdomen, enters into the liver at the top of that great tranfverfe cleft which divides the liver into two lobes ; and after entering the liver, it begins, as if it were the regular and peculiar veffel of the liver, to diftribute branches through its fubftance from right to left.

In figure 1.—(*a a*) fhows the umbilical vein.—(*b*) the point at which it enters the liver—(*c, d, e, f,*) branches given to the fubftance of the liver, till at laft it gives off (*g*)—a very great branch, which is indeed the chief trunk for the left fide of the liver ; it branches out in the liver like the oppofite trunk, (*m*)—But I cut it off fhort, left it fhould confufe the plan. Next comes (*h*)—the ductus venofus, whofe office is important, but whofe fize is not quite what we fhould fuppofe. It comes off direct from the umbilical vein ; its courfe is fhort, and a little curved ; it joins at (*i*)—the largeft of the hepatic veins, *i. e.* of thofe great veins which return the blood from the liver, and along with it goes directly into the right auricle of the heart, which is marked (*). —This, perhaps, might fuffice as a defcription of the ductus venofus ; but it is convenient, and will make a clear fubject, to finifh that circulation of which this ductus venofus is one of the chief difficulties.

This I confider as the end of the umbilical vein, for here its circulation ends ; or, if it fends blood into the right branch of the vena portæ, its proportion is but fmall. But the VENA PORTÆ (which is juft the collection of all the abdominal veins into one trunk,—of the fplenic vein (1)—of the mefenteric vein (2)—of the hemorrhoidal vein, *i. e.* the vein from the pelvis (3); —the vena portæ, I fay, compofed of all thefe veins, is the true vein of the liver.

<div align="right">The</div>

Fig. 2

Fig. 1

Vena-Cava-Abdom:

The branches of the vena portæ are gathered into a trunk at (k)—that trunk enters the liver at (l)—it divides into two great tranfverfe branches at (m) and (n)—the one ferving the right fide of the liver and the other the left; but in the fœtus this left branch (n) is not known as the limb or left branch of the vena portæ, but looks rather like the right branch of the umbilical vein; indeed, it is named fo by Mr. Bertin.

But that I may not convey vague uncertain notions of veffels apart from the organ which they are to fupply, I have in figure 2. laid thefe veffels upon an outline of the liver; by which I am fure to explain correctly, 1. How the umbilical vein (a) enters at (b) into that great longitudinal cleft which parts the liver into two lobes. 2. How it begins, as if it were the peculiar veffel of the liver, to diftribute its branches (c, d, e, f,) from right to left. 3. How the laft great branch (g) of the umbilical vein is the left trunk for fupplying the left fide of the liver with blood. 4. How the ductus venofus (h) goes off in the moft direct manner from the umbilical vein, and the faireft for receiving its full proportion of blood; and how it carries that blood directly onwards to the back of the liver, or that part which touches the diaphragm, and there the ductus venofus enters the heart *.

But my third plan explains the adult liver as if thefe branches had never exifted. The two firft plans fhow what are its veins in the fœtus. This third plan fhows what are its proper and permanent veins; for thofe peculiar veins which we find in the child are accommodations for the fœtus, are ranked among the peculiarities of the fœtus, and are, when the child is born, obliterated by a new circulation; and what is very curious,

* The lobes of the liver in figure 2. are marked thus:—(1) The great right lobe—(2) The great left lobe—(3) The little lobe, or Lobulus Spigelii, lying betwixt them; and it fhould be remembered, with regard to the pofition of the liver in this drawing, that it ftands upright, as if pulled up by pulling at the umbilical vein (a)—or at the round ligament, which is the fame thing (for the vein is converted into this ligament), fo as to bring it into a perpendicular pofture, and fhow the back line of the liver (4, 4)—where it touches the fpine and diaphragm.

by

by a circulation which goes through the fame veffels in a retrograde courfe.

In this third plan I reprefent the liver of the adult ; I confider only the vena portæ, which is its proper vein, and I give the vein and the liver itfelf in a new form. This plan is drawn from an adult liver, moft of its fub-ftance being diffected away.—(a) Marks the right lobe—(b) the left—(c) the lobulus Spigelii. Thefe are fuf-ficient to mark the more important points, and I have not fpared the fubftance of the liver in other parts where veffels were to be fhown.—(d) Is the fhape of the vena portæ tied after injection, and cut fhort and twifted a little fo as to make it ftand almoft perpendicularly—(e) and (f) are the two great lateral branches going to the right and left fides of the liver ; and this cylindrical part of this very great vein is called the finus of the vena portæ. It is fo formal, lies fo fairly at right angles with the vena portæ, goes fo regularly into two equal limbs, the branches too, even when fpreading in the liver, are fo formal, that it looks more like a piece of human me-chanifm than any thing belonging to the living body: it appears fo here, not from the ftiff and awkward forms which a plan muft have, but becaufe it is thus in nature. The right branch (g) is diftributed very formally to the right fide of the liver :—(h) The oppofite branch is dif-tributed as formally to the left; and there is no mark or note by which it can be known that this left branch had ever proceeded from the umbilical vein, or been filled by it, or been any thing but what it now appears, the left branch of the vena portæ correfponding moft regularly with the right. And in the fame way it may be obferved, that the middle veins of the liver (i, k, l, m,) are now plainly known to be legitimate branches of the vena portæ, though they appeared in the fœtus to be proper branches of the umbilical vein : they are named fo by Bertin and others, the beft anatomifts ; but that they are plainly not fo, becaufe the umbilical vein (fince thefe branches go off at an angle) filled them only by a backward courfe, while here in the adult they are filled
by

Third Plan of the Liver
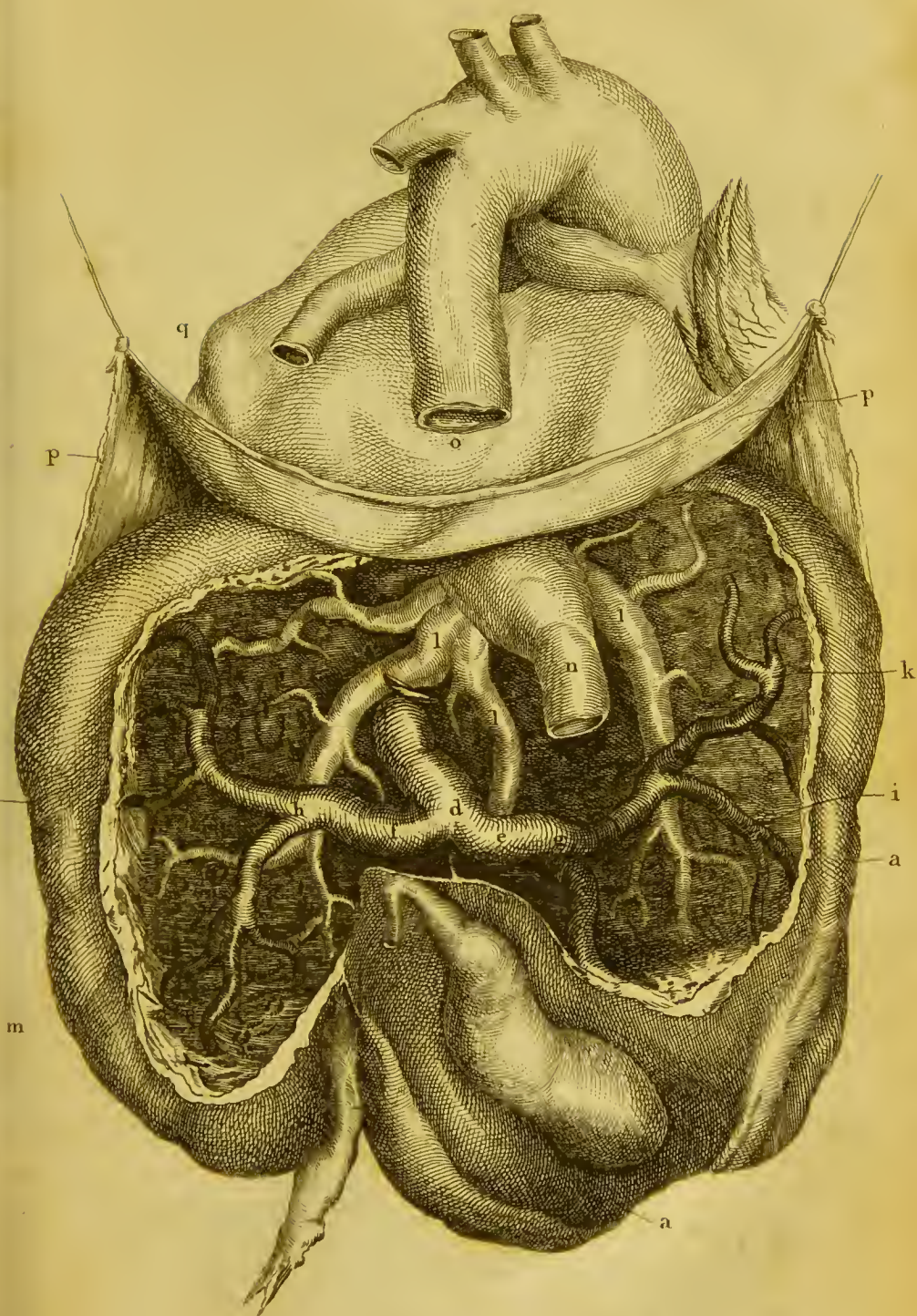
is the Vena Cava Abdominalis o is the place where the Cava enters the right
Auricle p is the Diaphragm upon which the right Auricle lies and the heart &
arteries are seen above the Diaphragm q being the apex of the heart

by their natural trunk, the vena portæ, in a more na-
tural way.

Now, by glancing the eye from the circulation of the
fœtus to that of the adult, we obferve thefe changes :
Firft, The liver of the fœtus has blood circulating in two
directions ; the right fide of the liver is filled from the
vena portæ, the left fide by the umbilical vein. The
liver of the fœtus having two veins has a large quantity
of blood, a growth larger than that of any of the vifcera ;
and indeed the liver alone feems to fill all the upper
region of the abdomen. This is changed when the
child is born; the umbilical circulation is cut off and
the liver of the child ceafes to grow but in proportion
to the other parts *. Next, we obferve in the fœtus
how the umbilical vein runs into the left branch of the
vena portæ, infomuch that the left branch of the
portæ has not any determined form ; nor has the finus
vena portæ, or the horizontal fhaft of this vein, that
peculiar and formal fhape which I have already obferved.
This fhape, then, of the finus venæ portæ, is not to be
looked for in the child, and is not found in thefe plans.

Again, we find in the adult thofe blood-veffels obli-
terated which ferved fuch peculiar ufes in the fœtus ;
the blood which flowed formerly into all the left fide of
the liver by the umbilical vein now comes along the
venæ portæ ; thefe veins are now working their
blood in a retrograde courfe ; the blood which flowed
once in the direction (i) N° 2. runs now in the direction
(k) N° 3.

In this plan are feen alfo the hepatic veins, or branches
of the vena cava, in the liver. Thefe three great veins
marked (l l l)—are the returning veins, which carry back
to the heart that blood which the venæ portæ (affuming
the office of an artery) circulates in the liver ; and it is
with one of thefe that the ductus venofus joins before it
enters the heart.

* One is forced to fpeak this unphilofophical language, though
the fize of the liver in the fœtus is as juft and well proportioned to
the fœtus, as that of an adult body is to an adult body.

Plan of the For: Ovale
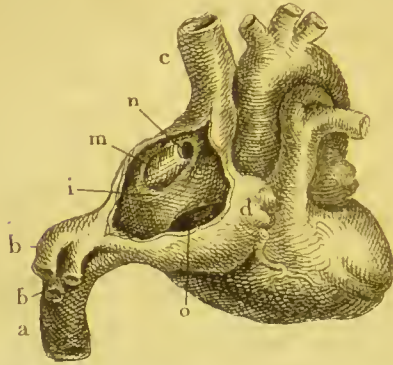
FORAMEN OVALE.

THE foramen ovale, the second peculiarity of the
fœtus, is a hole of no inconfiderable fize, tranfmitting
the blood freely from the right to the left fide of the
heart.   Its ufe is obvious, even from a general view of
the fyftem ; and when we look more clofely into its
mechanifm, its ufes are completely explained.   Its
valve being placed on the fide of the left auricle, per-
fectly fettles (and that by the only authentic proof) the
courfe of its blood : and, fatisfied with the defcription
which I am now to give, I decline all difputes about the
nature of this opening, or its valve.   This is a fubject
which difputes may perplex, but cannot explain.
Another reafon which I have for declining fuch contro-
verfies, is this : It is an eafy matter to impofe upon a
whole academy, eafier by far than upon one ingenious

EXPLANATION of the PLAN of the FORAMEN OVALE.

(*a*) The afcending cava, with its hepatic branches (*b b*)—
(*c*) The defcending cava.—(*d*) The right auricle, where it lies againft
the roots of the aorta and of the pulmonic artery—(*i*) The ifthmus
Veuffenii, as it is called, or circle which furrounds the oval hole—
(*m*) The valve of the foramen ovale—(*n*) A fmall opening, which
we always find towards its upper part—(*o*) The opening toward
the ventricle.—This plan is intended chiefly for fhewing the true
place of the foramen ovale ; its anatomy and juft form is better repre
fented in the true drawing which ends this fubject.

man

man : and thus it came to pafs that in the French Aca-
demy each theorift brought diffections of the heart and
foramen ovale fuited to his own doctrines ; each, when
convenient, changed his ground a little, and brought
new diffections; and thus valves and auricles, fœtal and
adult hearts, double Cats and human monfters, made
their annual exhibitions in the halls of the French Aca-
demy : the Society never fickened nor tired, and the
raree fhow lafted exactly one hundred years.

What kind of doctrines were current at fuch a time it
is almoft fuperfluous to explain ; yet I think it not
amifs to remark two examples, of obduracy on the one
hand, and of ingenuity on the other, in two of the
greateft men. Mr. Mery had conceived notions about
the circulation of the blood in the fœtus, which can
hardly be explained * ; but it was one point effential to
his doctrine, that the blood in the fœtus moved directly
from the left auricle to the right. He was forced to
deny that the foramen ovale had a valve ; and this doc-
trine he continued, with many quirks and tricks, to
maintain to his dying day. Mr. Winflow agreed with
Mery ; he faid, that the foramen ovale had no valve ;
that though it had a membrane, that membrane per-
formed nothing of the office of a valve ; that the blood
paffed freely from right to left, or from left to right, as
occafion required ; that thus the two auricles were as
one. He forgot for a time that there is but little circula-
tion in the fœtal lungs ; that the right auricle is filled
with all the blood of the body, while the left is filled
very fparingly by the pulmonic veins. From thefe data
it is plain, that the balance muft always be in favour of
the right auricle ; that it always muft be more full of
blood ; that without fome valve the blood muft rufh with
a continual preffure from right to left ; while, again,
the place of the valve is itfelf a demonftration that the

* All that can be done towards the explaining it in one word is
this : He " fancied that the right cavity of the heart was fo large and
the left fo fmall, that always the left fide was obliged to difgorge
again upon the right fide ; and this was the meaning of the blood
rufhing through the foramen ovale from the left fide to the right."

blood

blood cannot pafs from left to right. Winflow, when he fome years after perceived that he had fpoken idly upon this fubject, left Mr. Mery among his foolifh arguments and differions, and retracted all that he had written, with a manlinefs of fpirit which deferves to be recorded.

The foramen ovale is not ftrictly oval, but is rather round. In the plan it appears oval, becaufe there I have endeavoured to reprefent the condition of the veffels when the heart is dilated and the veffels full; but when we lay it out for demonftration or for drawing, it appears, as in the drawing, of a rounded fhape.

The oval hole is in the partition betwixt the two auricles at its very backmoft point; for, in fact, the auricles touch each other only behind; at their fore-part they are feparated by the roots of the aorta and pulmonic artery, as may be feen in any of the plans. We look, then, for the foramen ovale at the very backmoft part of the right auricle; or rather it is placed fo high in the auricle as to feem to belong rather to the root of the cava defcendens.—A ring rifes round the borders of the hole, very prominent, and exactly like the ring of the meatus auditorius internus in a child.—This was named ISTH-MUS VEUSSENII; but this conceited name of ifthmus, Veuffens gave it, is quite unintelligible, and it muft be changed for that of the CIRCULUS FORAMINIS OVALIS, the ring or circle of the oval hole.—This circle is thick at its edges; very ftrongly mufcular, like the mufculi pectinati of the auricle; in fo much that authors of fome character have thought this a fphincter for the oval hole. There is no doubt a kind of decuffation of the fibres at each end of the oval hole; fo that thefe fibres, forming a fort of pillar on each fide or edge of the foramen, the name of Pillars of the Ring, or COLUMNÆ FORAMINIS OVALIS, is lefs exceptionable; though thefe pillars, or any thing deferving fuch a name, will not be eafily found by one beginning anatomy.

The valve of the oval hole lies entirely on the left fide, as the round edges of the right fide may demonftrate. By taking the blunt probe, we find we can lift

it

it towards the left fide; but being pufhed towards the right fide, it rifes into a fort of bag, and oppofes the probe. The valve is perfectly tranfparent; it feems delicate, like all the other membranous valves, but is really ftrong. There is often left, after the clofing of the valve, a fmall opening at its upper part. The valve clofes foon after birth: the hole is fo large, that this membrane forms a very large fhare of the partition betwixt the auricles; its tranfparency is fuch, compared with the reft of the walls, that it is as diftinct in a boy, or in an adult, as in a fœtus.

This is the anatomy of the oval hole, and of its valve; and this proves, and any one who examines it will entirely be convinced, that the blood of the fœtus paffes through it from right to left *.

True Drawing of the Foramen Ovale:—
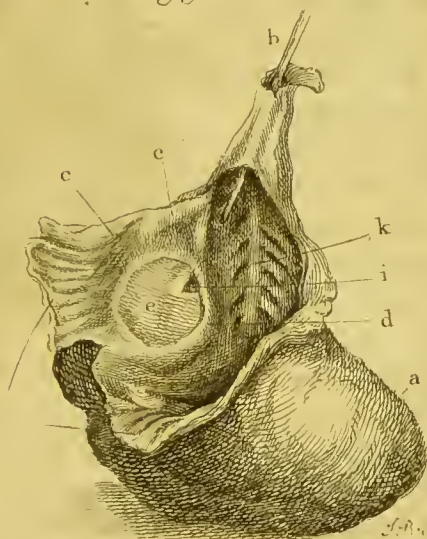
* This heart of a fœtus had all its parts cut away, except the ventricles (a a)—the vena cava, with a blow-pipe in it (b)—and the wall or partition betwixt the auricles (c c)—which is here unfolded, to fhew the foramen ovale. The mufculi pectinati, or mufcular fibres of the auricle, are well feen at (k k)—(d) Is the annulus foraminis ovalis.—(e) Is the valve itfelf.—(i) Is the fmall opening in the upper part of the valve, where the valve falls flack, and ready to open.

DUCTUS ARTERIOSUS.

THE ductus arteriofus I have defined a great inofcula-
tion betwixt the pulmonic artery and the aorta ; not for
the purpofe of conveying away that blood which fhould
pafs through the lungs, but for giving to the blood of the
aorta the propelling power of both ventricles : and how
well it is able to perform this office, will be eafily feen
from the drawing on my margin *.

The pulmonic artery
of the adult divides, as
has been marked in all
my former plans, into two
great arteries, one going
to the right fide, another
to the left ; but in the
fœtus there arifes a mid-
dle branch betwixt thefe
two. It is larger than
both put together ; it is
in the middle, and fo
comes moft directly from
the heart ; it goes in a
ftraight line towards the
aorta, and joins with it
immediately below the
arch. This is the ductus arteriofus, the centre branch
of the three branches into which the pulmonic artery

Ductus . Arteriosus

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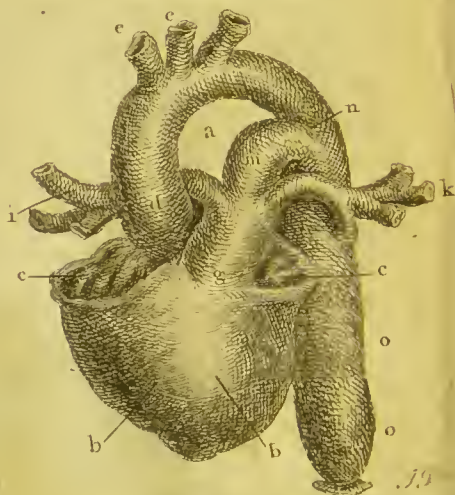
* This fketch is taken from a little preparation made on purpofe,
where a quill was thruft in fo ftrongly betwixt the ductus arteriofus
and aorta, as to feparate them unnaturally, and leave a fpace (*a*) be-
twixt them.—(*b b*) Marks the two ventricles—(*c c*) the place from
which the two auricles were cut away to make every thing clear.—
(*d*) the root of the aorta, known by (*e e*) its carotids.—(*g*) Is the
root of the pulmonic artery—(*i*) the right and (*k*) the left pulmonic
arteries—(*m*) the ductus arteriofus, or middle branch, running into
the aorta—(*n*) the place where they join—(*o o*) the aorta increafed in
fize by this addition.

N. B. This heart is but a very little under the natural fize in a new-
born child.

of the fœtus is divided. It is bigger than the aorta in the fœtus; it gives the full force of the right ventricle to the blood of the aorta, in addition to that of the left. In the adult it is fo thoroughly obliterated, that by the moft careful diffection we can fhow no other veftige of it than a cord-like adhefion of the aorta and pulmo-nic artery.

Thefe, then, are the chief peculiarities of the fœtus * ; but the conclufions which have been drawn from this mechanifm are, as I fufpect, very far wrong. But this I can in no fhape prove, till I fhall have firft reprefented the real condition of the fœtal heart. Firft, then, let it be obferved, that every drop of blood which comes into the fyftem is, either by the powers of the placenta, or by communion with the mother's fyftem, oxydated blood. —One part of this blood, indeed, paffes through the circulation of the liver before it reaches the heart, while another paffes more directly through the ductus venofus; but both are mixed, and the blood is all of one quality when it arrives at the auricle, in order to fill the heart, and to begin its courfe round the body. Now, fince the blood is all of one quality, Nature could have no caufe for dividing fuch blood into two portions; one to pafs through the lungs, the other to pafs over the body. She could have no motive for employing, as in the adult, two hearts. The defign of Nature, plainly is, to prepare a double heart, and keep it in referve for the circulation of the adult, but to ufe it in a fingle heart in the fœtus. And fee how fimply this is accomplifhed. The two auricles com-municate fo freely by the foramen ovale, that they are as one: the two ventricles both deliver their blood into one veffel, the aorta; and they are alfo as one. The blood arrives by the cavas, fills the right auricle, and in the fame moment fills, through the foramen

* The umbilical arteries muft be explained in another place.

ovale,

ovale, the left auricle ; fo that the auricles are as one, and filled by one ftroke ; the two auricles act at once, and fo the ventricles alfo are filled by one ftroke ; the aorta receives the blood of both ventricles at one ftroke. So that, in the ftricteft fenfe of the word, the fœtus has but one fingle heart, the heart of the body (the function of the lungs being performed by the pla-centa, far from its proper fyftem) ; and when the function of its own lungs begins, then Nature, by the fimpleft of all mechanifms, divides the two hearts, that they may perform each its peculiar function. Firft, the flow of blood into the lungs deprives the ductus arte-riofus of blood ; and, fecondly, this flow of blood coming round to the left auricle of the heart reftores the balance, preffes down the valve of the foramen ovale, and makes the partition betwixt the auricles entire. In fhort, while the oval hole and ductus arteriofus are open, it is a fingle heart ; and when they clofe, as they do the moment the child is born, it becomes the double or perfect heart.

Now the miftake which all phyfiologifts have fallen into is this, They have not obferved that no creature can live with a fingle heart, which has the oxydation of its blood performed by lungs. A fifh lives by a fingle heart, becaufe its blood is oxydated by gills, not by lungs: Infects live with a fingle heart, as their lungs, or the branches of their lungs, are diftributed like arteries over all their body : The fœtus can live with a fingle heart, becaufe its blood is oxydated by the placenta. And that this idea may make a more determined im-preffion, it will be good to prove, that the function of the placenta actually is equivalent to the function of the lungs; and that it is the placenta itfelf that produces this change upon the blood, I am the rather inclined to believe, becaufe we fee the veins and arteries of the Chick fpreading over the membranes of the egg, and we can obferve the artery fending dark-coloured blood into thefe membranes, while the vein brings back florid or oxydated blood.

If, during child-labour, the umbilical cord falls down
                                                    before

before the head of the child, at firſt it is not preſſed but beats ſtrongly, and the fœtus is felt ſtruggling in the womb ; but when, after a few pains, the head deſcends into the pelvis, the cord is preſſed betwixt the head and pelvis, the pulſe falters, ceaſes ; the child ceaſes to ſtir in the womb ; and if not born in a few minutes is irrecoverably dead, and is black in the face like one ſtrangled or drowned. When a child comes with its feet or other parts of the body firſt, the head being laſt delivered, is difficultly delivered ; the accoucheur ſtruggles long in bringing out the head ; the umbilical cord is compreſſed all the while, and the child dies. The ductus arterioſus, nor the oval hole, cannot ſave the child, for it dies becauſe it is deprived of the function of the placenta, which is the fœtal lungs ; and this is the cauſe why it appears like one ſuffocated or drowned.

When the child is born, lay it upon your knee, the cord being uncut, and you will obſerve that the one function declines exactly as the other ſtrengthens. That if the child do not breathe freely, the cord will continue to beat ſteadily, the placenta ſtill continuing to perform the function of the lungs : That when the child begins to cry freely, the pulſe of the cord and the function of the placenta ceaſe at once. If the child breathe freely, but yet do not cry, and you tie the cord, it is inſtantly forced to cry for a fuller breath ; and if a raſh perſon tie the cord prematurely, when the child neither cries nor breathes, he cuts off the function of the placenta before the function of the lungs is eſtabliſhed, and often the child is loſt : this, in the hurry and officiouſneſs of ignorant women, happens every day. If even after two days the child's breathing be much interrupted by coughing, crying, or any ſpaſmodic affection of the lungs, Nature ſeeks again the function of the placenta, and the pulſe returns into the cord ſo as to raiſe it from the belly of the child. Theſe things prove what the beſt phyſiologiſts have forgotten, or have not known, that the fœtus has, in the function of the placenta, ſomething equivalent to the function of the lungs.

One

One great miftake then runs through the whole of phyfiology. It has been univerfally believed that the free and eafy tranfmiffion of the blood was the chief ufe of the lungs, as if they had acted like fanners to flap on the blood from the right to the left fide of the heart. They affirmed, that either continued diftenfion, or continued collapfe, hindered the progrefs of the blood; and they alfo believed univerfally, that if but the ductus arteriofus or foramen ovale, or any thing, in fhort, were left open to let the blood pafs, that perfon might live in fpite of hanging, drowning, or fuffocation of any kind.

This will be found to be the moft perfect of all abfurdities; and to alledge fuch a thing againft all authors requires fome kind of proof; it will fuffice, if I prove it againft a few of the moft eminent. So much were the older authors wedded to this mifapprehenfion of the dilatation of the lungs being ufeful only by driving forwards the blood, that, in the Parifian diffections, we find the following experiment made on purpofe to prove the fact. " We have alfo made another experiment (fay the Parifian diffectors *) to know more diftinctly the neceffity of the motion of the lungs for the entire circulation of the blood. An injection being made by the right ventricle of the heart into the artery of the lungs of a dead Dog, it happens, that if one continue to make the lungs rife and fink alternately by means of bellows put into his trachea, the liquor pufhed into the artery does eafily pafs and go through the vein into the left auricle; but when one ceafes to blow, it paffes not but with a great deal of difficulty," (page 262.)—Which doctrine is dilated into its full abfurdity in the next paragraph. " Having viewed the difference of ftructure in a Tortoife and in a Dog, it is eafy to give fome probable reafon of the phenomena of thefe experiments; and the reafon is, that it is neceffary that thefe veffels fhall be

* N. B. This was a wheel within a wheel; it was a committee of the great academy, who were feparated into a fmaller fociety for inveftigating the organization of all ftrange animals; and a very pretty account they gave of them, as fhall be feen prefently.

dilated

dilated for the receiving of the blood of the right ven-
tricle of the heart, and that they may be afterwards com-
preffed in expiration to prefs out the blood, and make it
pafs into the left ventricle." Swammerdam indeed fays,
concerning the Frog's lungs, that an artery goes over
them, which has no other purpofe but to nourifh the
lungs; and that it is of the nature of thofe called bron-
chial arteries in Man. But the College of Diffectors
have plunged ftill deeper into this remarkable blunder;
for they fay (page 261.), in fpeaking of the lungs of
Newts, Frogs, and other creatures which I have repre-
fented as having a pulmonic artery extremely fmall in
proportion to their fyftem, " that in fuch creatures the
lungs have merely that quantity of blood paffing through
their fubftance which is neceffary for their own particu-
lar nourifhment;" which is faying in the plaineft terms,
that they have lungs (only, I fuppofe, that they may be
like other creatures); but their lungs are of no manner
of ufe, except to nourifh themfelves.

One fhould have thought that the folly of this opi-
nion would have appeared more ftriking in proportion
to the earneftnefs of thefe arguments, and that no fub-
fequent author would have deigned to honour fuch an
opinion fo far even as to notice it: but behold the cele-
brated Haller not only adopts this notion very fully,
but enriches it with further explanations, faying, " that
the veffels are all, during the contraction of the lungs,
forced into numerous angles and joint-like folds; that
the angles are made even, and the paffages of the blood
more direct upon the expanfion of the lungs." As if,
forfooth, the lungs (which, as I fhall prefently demon-
ftrate, fcarcely move in refpiration) folded and clofed
upon each other like the wings of a Butterfly or Beetle *.
Santorini alfo reprefents the veffels of the lungs as thus
collapfed, plaited, and folded a thoufand various ways
" affaiffé et replié de mille manieres differents, &c."—
" One effect of expiration (fays Haller) is fo to com-

* " Præterea, in vivo animali, cujus cor contrahitur, et in arterias
pulmonales fanguinem data vi emittit, omnino nunc fanguis in eas
arterias facilius, atque adeo celerius irrumpit, poftquam deletus re-
tardatricibus plicis, recta nunc funt."

prefs

prefs all the arteries of the lungs, that they cannot re-
ceive the blood from the ventricle of the heart fo freely
as they are wont to do *.

" It muft feem very ftrange for me, after faying that
inflating the lungs reftores an animal after apparent
death, and recovers the drowned, to affirm that long
continued-refpiration is fatal †: and yet we need not
look long for the caufe of this; for during this long
continued infpiration, much blood muft be gathered in
the lungs, but none can get out ‡." Nothing is attri-
buted, in his explanation, to the want of air, but all is
attributed to the obftruction of the blood : yet if this
were all, Amphibiæ would need no lungs, fifhes would
need no gills, infects could need no air-tubes; for none
of thefe affift the motions of the heart. Monro, who
puts Haller to rights in every thing elfe, follows him in
this. " In all amphibious animals, therefore," fays
Monro, " every part of the body may receive a con-
fiderable portion of blood, although the refpiration and
free paffage of the blood through their lungs be inter-
rupted," &c. (p. 21.) And the celebrated Blumenbach,
the man moft admired on the continent for his Phyfio-
logy, fays, at p. 80. " Poft extremam refpirationem
redeunti per venas cavas fanguini via fueta in pulmones
nunc collapfos præcludatur §.

Thus

* Verum alter effectus expirationis eft utique pulmonis arterias
ita comprimere, ut ne pari facilitate fanguinem a fuo cordis ventri-
culo recipiant.

† " Paradoxum videri poffit, ab infpiratione fanguinis in pulmo-
nem commeatum expediri : inflato etiam aëre, quod genus eft magnæ
infpirationis, animalia moribunda revivifcere, et fanguinis per pul-
mones iter revocari : et tamen hanc eandem, adeo faventem fanguinis
per pulmonem motui infpirationem, fola paulo diuturniori continua-
tione, anxietatem primo incredibilem facere, deinde, fi vel voluntatis
violento imperio tamen aer in pulmone retineatur, vel ab alia caufa
intra pulmonem copiofior fervetur, denique faniffimum et fortiffimum
hominem fubito interire."

‡ " Hujus nunc anxietatis et fuffocationis, et denique mortis
caufam non eft arduum invenire. Adparet enim, ab infpiratione
diutius continuata, fanguinem in pulmonem quidem advenire, et
congeri, exitum vero ex pulmone non invenire."

§ Mr. Keate, one of the lateft writers on the recovery of drowned
perfons, has the fame notion. " We inflate and empty the lungs
(fays

Thus I have proved, that it has been the opinion down to the prefent day, that the collapfe or over diftenfion of the lungs are both equally oppofite to the eafy paffage of the blood : but inftead of going round about the matter flyly, as fome leffer authors have done, I like rather the manner of the Reverend Dr. Hales, who fays plumply, " that fuffocation confifts in the falling flat of the lungs," (p. 271.) He talks in this way, becaufe, like Buffon, Derham, Des Cartes, and fome others, he was a philofopher by inclination, and by force a fort of an anatomift.

Now, the condition of the human lungs is quite oppofite to all this ; and alfo (in refpect of diftenfion) is lefs different from the lungs of reptiles than it is eafy for any one bred up in the old doctrines to conceive.

In expiration the lungs do not even collapfe in any fenfible degree. Let us take for our data the common calculations concerning the quantity of air in the lungs, and let us fee what they will do towards proving this opinion. The lungs are fuppofed to contain at the time of their utmoft fulnefs about 220 cubic inches of air. When we continue breathing in a natural and eafy way, we draw in and expel alternately about 40 cubic inches of air ; but when we choofe to force refpiration, we find that we can expel without danger or harm 70 inches more ; we can expel 110 inches of air, leaving only 110 inches remaining in the lungs. Now let us, for a moment, obferve how little danger or diftrefs it occafions when a forced refpiration is made—fuch as is ufed in coughing, laughing, fpeaking, crying, expelling the child, urine, or feces, bracing up the body for the lifting of heavy weights, or other violent occafions, for which fuch forced refpirations are by nature referved. Let us notice how much forced refpiration exceeds the ordinary refpiration, and how fmall a proportion the

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(fays he), in order by their expanfion and contraction to FORCE the blood acrofs from the right to the left fide of the heart."—and he expreffes himfelf as perfectly indifferent what kind of air be ufed, foul or pure is all one.

quantity

quantity of an ordinary breathing, viz. 40, bears to
220, the whole quantity of air within the lungs. Re-
flecting thus what large infpirations of air we may take,
and how very little we do take, we begin to perceive
how gentle the motion of the lungs muſt be.

There remains always within the lungs a great maſs of
air, which I will call the permanent dilatation of the
lungs, which, from the firſt movements of the child,
from the hour of birth till death, and even after death,
muſt remain in the lungs. This maſs, equal to 220,
cannot be entirely breathed out ; even the utmoſt force
of refpiration expels but the half : this is never done but
on extraordinary and moſt urgent occaſions, which do
indeed diſturb the circulation ; as coughing, laughing,
crying, or running do. But this great maſs is feldom
fo moved ; it is regularly and gently agitated by the
change of 40 parts of the 220 which we expire and draw
in again at each breath : we do not empty and fill the
lungs at each breath ; there is, on the contrary, a per-
manent expanfion of the lungs, and a maſs of air always
in them ; there is along with this a gentle and regular
agitation ; and there is changed at each refpiration a
fmall proportion of this maſs of air. Our lungs are
little different (in refpect of diftenfion) from thoſe of
Amphibiæ : for their lungs alfo, as I have defcribed in
the Frog, are permanently expanded, and at each refpi-
ration a little dilated and contracted ; the air a little
changed, a little moved, a little renewed ; the change is
in both cafes placid and gentle, and hardly to be per-
ceived.

With thefe opinions concerning the ſtate of our lungs,
nothing can appear to me more coarfe than the notion of
their being entirely filled and emptied at each breath ;
nothing more ignorant than the fuppofing them to fall
flat, as Hales expreffes it, fo as to hinder the motion of
the blood : and the groffnefs of this opinion appears in
its true light when I put down this laſt proof, viz. that
for each act of refpiration there are four pulfes of the
artery, or four ſtrokes of the heart. Is it not plain,
then, to the meaneſt apprehenfion, that if the blood

5   moves

moves twice through the lungs in expiration, and twice during infpiration; or, in other words, if there be four ftrokes of the artery for each refpiration, and if each of the four pulfes be equally ftrong, that the blood paffes through the lungs in all ftates and conditions with equal eafe * ?

It is alfo univerfally believed, and it is indeed a moft legitimate conclufion, from this doctrine of the collapfe of the lungs hindering the paffage of the blood, that if but the foramen ovale or any paffage be left open to let through the blood, that perfon will live without breathing.

It has been affirmed, that the Seal, the Beaver, the Otter, have the foramen ovale open. In the Seal, the Parifian diffectors found the oval hole open as in a child; but when they came to the foramen ovale of the Beaver and Otter, they found them, and fore againft their will, quite clofe. In their difappointment they could have faid any thing; but all that they thought prudent to fay was, that the Beaver had not been in the water for a long while, not even to refrefh himfelf †, and the Otter had been clofe penned up in his hut at Verfailles; and fo the foramen ovale had clofed in thefe poor beafts quite clofe; and behold they were no longer Otters and Beavers, but little better than dogs ‡. Although
Haller

* Their old and favourite experiment, fo often repeated by Hooke, Croone, and others, before our Royal Society, viz. of blowing up the lungs of a Dog, and then compreffing them, is good for nothing: for there the thorax is cut clean away; the permanent diftenfion of the lungs is entirely loft; and then, no doubt, there is fuch a collapfe of the lungs, as may, or rather muft, hinder refpiration; for the lungs are alternately diftended to the greateft degree, and then emptied as completely.

† The Beaver fits in his hut juft up to the hips in the water, and builds his hut fo that he may fit juft up to the hips.

‡ Cette ouverture, qu'on appelle le trou ovalaire dans le fœtus, fait l'anaftomofe par le moyen de laquelle le fang va de la veine cave dans l'aorte fans paffer au travers du poumon; et c'eft apparemment pour une même ufage que ce paffage fe trouve dans le veau marin que dans le fœtus, à caufe du befoin que l'un et l'autre ont de fe paffer de la refpiration, fçavoir le veau marin pendant qu'il eft

Haller * declares that he had found the foramen ovale open in a man who was hanged ; though Rœderer, Chefelden, and many creditable witneffes, have teftified the fame ; ftill there has gone along with thefe confufed doctrines about the foramen ovale a kind of dream (like that concerning the transfufion of the blood), that if but the foramen ovale could be preferved open, Man even might be made an amphibious creature.   At firft this notion began to peep through the mifts of this doctrine; and you might find an author, when he had diffected a perfon with the foramen ovale open, infinuating by oblique notions, what a vaft pity it was that the man had not known, during his life, how kind nature had been to him, and what a perfect diver he was ! while another fays plainly, on a like occafion, " what a pity it was that this child did not live !" we fhould have feen almoft an amphibious human animal, at leaft a moft notable diver †.   On this flender ground they told the moft wonderful tales, among which Pechlinus's ftory of the Tronningholm gardener is one of the prettieft.   " The ice having broken, the gardener, in trying to help out fome others, as frequently happens, flipt in himfelf into a place full eighteen yards deep.   There he no fooner touched the bottom, than he felt as if you had clapt a plafter over his mouth ; his feet ftuck faft, his body became rigid, and he ftood there as ftiff as a ftake, with no one of his fenfes about him, except only that he thought he heard all the while the Stockholm bells ringing moft pleafantly ; and there he ftood for fixteen hours, the folks feeking him up and down, and wondering where he could be : at laft having found him, they hooked him out with a pole ; and after much warming, and

plongé dans l'eau, et le fœtus pendant qu'il eft dans le ventre de fa mere, où il eft certain que les anaftomofes fervent a décharger le poumon de l'abondance du fang qui le fuffoqueroit."—Vid. *Acad. des Sciences*, Anno 1699, page 149.

* Vol. II. Part 2. p. 11.

† Mr. Chemineau fays, " On auroit vue avec étonnement un Homme prefque amphibie comme la Tortuë."   Page 38.

I   rubbing,

rubbing, and working, and giving him hot drinks, they got his blood to circulate, and brought him to life again. He had fenfe enough, however, he faid, to feel their hook; and indeed they had angled fo ill, that his head was all bruifed, and he had terrible headachs : but, however, the Queen-Mother gave him a good penfion, and he was fixty-five years of age when Pechlinus wrote *." This is one of the many ftories of men preferved by the foramen ovale not having been fhut. At firft, I fay, this opinion began to peep out in hints and reflections ; then it ftrengthened into wonderful· tales of people being recovered who had been under the water fix days ; till at laft a great genius undertook to make water-whelps upon a new principle, viz. with the foramen ovale open. This great genius was the Count de Buffon. Indeed even this very year a very celebrated author, Dr. Beddoes, forgetting, perhaps, how fuccefsful Buffon is, tells us (page 41), that " by frequent immer-

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* Hortulanus Tronningholmenfis etiamnum vivens, annos natus 65, pro illa ætate fatis adhuc valens et .vegetus, cum ante 18 annos alii in aquas delapfo opem ferre vellet, forte fortuna et ipfe per glaciem incautius procedens, aquas incidit 18 ulnas profundas : *ubi ille, corpore erecto quafi ad perpendiculum, pedibus fundo adhæfit.* Conftitit fic per 16 horas, antequam produceretur in auras. Dixit autem, fimul ac infra aquarum fuperficiem fuit demerfus, *ftatim obriguiffe totum,* et, fi quem tum habuit motum et fenfum, amififfe nifi quod fonantes Stockholmii campanas etiam fub aquis obfcurius percipere fibi fit vifus. *Senfit etiam, ftatim fefe velut veficulam ori applicoffe,* adeo ut ·aqua nulla os penetraverit, in aures vero tranfitum, etiam fentiente illo, habuerit ; atque inde auditum fuum debilitatum aliquandiu effe. Hoc ftatum dum 16 horas permanfit fruftra quæfitus, tandem repertum, conto in capite infixo, cujus etiam fenfum fe habuiffe dixit, fundo extraxerunt, fperantes ex more aut perfuafione gentis revicturum effe. Itaque pannis linteifque productum obvolvunt, ne aer admitte poffit perniciofus futurus fubito ilapfu ! Cuftoditum fic fatis ab aëre fenfim fenfimque tepidiore loco admovent mox calidis adoriuntur fafciis, fricant, radunt, et fufflaminatum tot horis fanguinis corporifque motum negotiofa illa opera reducunt : denique antapoplecticis et genialibus liquoribus vitæ reducunt et priftinæ mobilitati. Retulit is atque oftendit fe etiamnum in capite circumferre veftigia violentiæ a conto illatæ et cephalalgiis vexari graviffimis. Et propter hunc ipfum cafum, religiofe a popularibus, et hujufce rei teftibus probatum, Sereniffimæ Reginæ Matris munificentia et annuo ftipendio eft donatus."

E 2

fion in water the affociation betwixt the heart and lungs might perhaps be diffolved, and an animal be inured to live commodioufly under water for any time."

Let us move juft a ftep backwards in this new trade of making amphibious animals, and obferve how the ce-lebrated Buffon fucceeded. " I procured a pregnant bitch (fays Buffon) of the large greyhound kind ; and when juft about to litter, I fixed her fo in a bucket full of warm water that her hinder parts were entirely co-vered. In this fituation fhe brought forth three puppies ; which, after being difengaged from their membranes, were immerfed in a fluid nearly of an equal temperature with that of the amnios. After affifting the mother, and wafl.ing the puppies in this water, I fuddenly re-moved them into a pale of warm milk, without allowing them time to refpire. I put them into the milk in pre-ference to the water, that they might have an opportu-nity of taking fome food, if they found a defire for it. I kept them immerfed in the milk for more than half an hour ; and when taken out of it, all the three were alive. They began to breathe, and they difcharged a quantity of fluid matter by the mouth. I allowed them to re-fpire about half an hour, and again immerfed them in the warm milk, where they remained another half hour. I then took them out : two of them were ftill vigorous, but the third feemed to languifh : I therefore ordered it to be carried to the mother ; which, befides the three brought forth in the water, had littered other fix in the natural manner. The puppy which was born in the water and had continued one half hour in warm milk before it was allowed to breathe, and another half hour after it had refpired, feemed to be very little incom-moded ; for it foon recovered, and was as active and lively as thofe which had received no injury. Of the fix that were brought forth in the air, I threw away four ; fo that there remained only two with the mother, befide the one that had been littered in the water. I con-tinued my experiments upon the other two which had been twice immerfed in the milk : After allow-ing them to breathe about half an hour, I plunged
them

them a third time into the milk, where they remained another half hour. Whether they fwallowed any of the milk, I could not determine ; but when removed, they appeared to be nearly as vigorous as before their immerfion." " I pufhed thefe trials no farther : but I learned enough to convince me, that refpiration is not fo indifpenfably neceffary to the exiftence of a new born animal as to an adult ; and that by employing certain precautions, it is, perhaps, poffible to keep the foramen ovale open : and, by this means, produce excellent divers, or a fpecies of amphibious animals, which would be able to live equally in air or in water."

I am forry to fay that I cannot pay Mr. Buffon the compliment of thinking that he was deceived in fo fimple an affair as this ; yet he certainly could not fucceed. I leave it with my reader to judge what fhall be faid of Mr. Buffon ; for it was not the foramen ovale that he was to keep open, if he wanted to make Amphibiæ ; but, fince the function of the placenta was juft cut off in thefe whelps, and fince he did not allow them the office of the lungs, he was to feek for fome other third function, which could ftand in place of the functions of the placenta and lungs ; and fince no fuch function has yet been obferved, I judge from all the principles which I have laid down, that Mr. Buffon was telling a vain-glorious idle tale ; that he was confcious that he had fucceeded in no degree : and that he could no more have converted them into amphibious animals, than he could have-made them what they were, viz. plain whelps. " Sed quis fallat omnifciam, ut fic loquar, naturam ? Illa non colludit noftris erroribus, et quod ignorantia celaverat fuo detegit tempore."

CHAP.

CHAP. V.

OF MALCONFORMATIONS OF THE HEART, AND OTHER
CAUSES, PREVENTING THE DUE OXYDATION OF THE
BLOOD.

WE are at no period of life, from the cradle to the grave, exempted from thofe difeafes which prevent the due oxydation of the blood. They often are born with us; they often overtake us when advanced in life; they caufe an anxiety and mifery, which exceeds all other diftrefs: pain and fuffering of every other kind humanity can bear, but the feeling of inftant diffolution is what the nobleft mind finks under. We know by the pale and fubfiding countenance how awful the inward feelings are, and woe be to him who has not feeling enough to fympathife with this diftrefs, and an anxious defire to underftand the caufe, and to alleviate the mifery of inward difeafes which he cannot cure!

These are feducing motives, and might of themfelves have drawn me on to give this flight fketch of the malconformations and difeafes of the heart: but I feel alfo the ftronger motives of duty and neceffity; for truly, without fome knowledge of the ill organized, irregular, and difeafed heart, the ftructure and functions of the heart in its founder ftate would be but poorly underftood. This fketch, then, is the laft part of this anatomy of the heart.

While the following hiftory ferves to correct our notions of the mechanifm of the heart, we muft alfo obferve how it explains and illuftrates up to a much higher point the combined functions of the heart and lungs, viz. the oxydation of the blood. Perhaps nothing can better explain the effects of a full and healthy oxydation, than a fparing oxydation of the blood, fuch as produces difeafe.

The fœtus alone can live with its fingle heart; it lives in the womb by its having a heart different from that of an adult. A fœtus, then, being born, cannot live with
that

that heart which ferved it in the womb; and Nature, as I have explained already, divides the fingle heart, and there is then a heart for the lungs and a heart for the body. But if any fault in the organization prevent this feparation of the heart; if the foramen ovale be pre-ferved open; or if there fhould be any hole in the fep-tum betwixt the ventricles of the heart; if the pulmonic artery do not admit the blood, now that the child is born, and fhould breathe the air; if the aorta arife from the right ventricle, fo as to carry off all the blood from the lungs; or if the aorta be fo difplaced, that its mouth ftands in part over both ventricles, fo as to receive the blood of both—then the organization, movements, func-tions of the heart, are all wrong; no blood paffes into the lungs, the child cannot live; it either dies imme-diately in convulfive ftruggles, or lives in mifery but a few years.

It is not in this rapid enumeration that thefe varieties of malconformation can be underftood, nor yet do they deferve to be minutely detailed. I fhall keep the middle path; and thofe of my readers will eafily follow me who have ftudied the mechanifm of the heart; concerning which this fubject will recal to their memory all the im-portant facts.

The moft ufual of all thefe diforders of the heart is fome fault in the pulmonic artery; and that diforder again is fruitful of others: for if the pulmonic artery cannot receive its blood, the foramen ovale cannot clofe: then the blood cannot circulate nor pafs into the lungs when they firft expand; then the office of the right heart is taken away, it has no power but to drive the blood with ftruggles through the foramen ovale into the left heart; the left heart then drives this blood, unoxy-dated as it is, into the aorta: the heart is now a fingle heart; it is the left heart alone that receives or circulates the blood: either it labours but for a few pulfes, and then the child, after a convulfive ftruggle, expires; or there is fome degree of opening in the pulmonic artery, a lit-tle blood paffes through it into the lungs; the child is

by

by that enabled to ftruggle with its convulfive pangs for eight or ten days, and then expires.

Such a fcene the celebrated Dr. Hunter once wit-neffed ; and there was, I perceive, in that heart a pecu-liarity very much to be admired. The chief fault was in the pulmonic artery, which was contracted into a folid fubftance or cord abfolutely and completely impervious, fo that the lungs had never received one drop of blood by the pulmonic artery. And here I muft ftop to notice one thing which I have always fufpected, and which this diffection proves, viz. that though it is natural to believe, and the beft phyfiologifts fuppofe it, that fome blood, as much at leaft as to fupport the form of the pulmonic veffels, paffes through the fœtal lungs ; yet here is di-rect proof that a well-nourifhed child may be born ca-pable of breathing, and in which the pulmonic veffels are all free except at the heart, in which not one drop of blood ever has paffed into the lungs. But chiefly it is to be obferved, that this child, with its pulmonic artery, quite impervious, could not have ftruggled a fingle day, far lefs ten days, without fome proportion of oxydated blood ! and accordingly we find that it had a fmall portion, juft fuch as fupported life for a few days ; which fmall proportion it obtained thus : The blood went to be oxydated, not from the right ventricle into the pulmonic artery, but from the left ventricle into the aorta ; from thence into the ductus arteriofus ; and then, by a retrograde courfe, backwards through the lungs ; and then by the pulmonic veins it was returned oxy-dated into the left fide of the heart, from whence it came. This child accordingly lived a few days, and could not live longer ; becaufe this difficult circulation was continually accumulating a quantity of black blood in the right fide of the heart.

This child, then, had a heart refembling that of the Newt or Frog ; for the pulmonic artery was clofed, and the right heart of no value ; the left heart pufhed its blood into the aorta, and the aorta, as we may exprefs it, fent a fide branch into the lungs. In this

firft

firft inftance, then, of malconformation, the child could not live, becaufe it wanted the pulmonary artery, and of courfe the office of the right ventricle ; it had but a fingle heart..

Next to this diforder of the pulmonic artery, viz. being obliterated or being clofed, is this : That the aorta, in place of arifing diftinctly either from the right or from the left ventricle, is fo placed, that its root ftands directly over the feptum ventriculorum, or partition of the ventricles ; that the partition is perforated with a large hole, opening a very free paffage from fide to fide ; and that the heart being cut up, we find, upon thrufting down the finger into the aorta, that it paffes with equal eafe into the right or into the left fide of the heart.— All which we are the lefs furprifed at, when we remember that in the Chick in ovo, the parts of the heart are all feparate pieces, which are joined one to another ; and that in the foetus of other creatures, in the Frog for example, the auricle, ventricle, and artery, are firft feen at a diftance from each other and then joined *.

In this conformation of the heart, the fingle heart appears again in a new form, and the office of the right or pulmonic fide of the heart is well nigh annihilated. Firft, The pulmonic artery is fmall, fometimes almoft clofe : Secondly, The aorta, arifing as well from the right as from the left ventricle, carries off one half of that blood which fhould be circulated through the lungs : And, laftly, That blood, fmall as it is in quantity, which has paffed through the lungs, is brought round to the left fide of the heart ; but the left fide is not as it fhould be, clofe, to keep this purer blood for the circulation of the body, but it is mixed with the blood of the right fide, through the perforated fep-

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* I do not mean to argue, that when we firft fee them, they are fo little connected, that one could be awkardly joined to the other, nor that they have no real connection, becaufe it appears as if they had not ; but merely this, that as they feem, like the parts of the eye, to be organized in feparate pieces, I fhould fooner expect an unnatural difplacement of the veffels of the heart than in the middle of the femoral artery.

tum,

tum, fo that its virtues, as oxydated blood, are diluted
or almoft loft.

If the pulmonic artery were unaffected, and the aorta
placed equally over both ventricles, then the one half
exactly of that blood which fhould be oxydated would
undergo the change. But in all thefe malconformations,
the root of the pulmonic artery alfo is in fault; it is
narrow; it is fo fmall, that at firft opening fuch a body
it alone attracts the eye; its mouth is fometimes fo befet
with a fort of flefhy granulous papillæ, that there is
hardly left opening enough to pafs a filver probe. The
degree of contraction in the pulmonic artery is the true
meafure of all the oxydated blood which that fyftem can
receive; but in fuch a fyftem the quantity is ftill farther
reduced by various accidents of the organization. Thus,
for example,—The pulmonic artery, is, we fhall fup-
pofe, but one-third of its natural fize, and the original
quantity of oxydated blood is proportionably fmall;—
next, the foramen ovale, being open, carries off much
blood towards the left auricle; the aorta, planted
over the right ventricle, carries off alfo much blood.—
But let us fuppofe, that ftill as much remains as to fill
the pulmonic artery to its full; when the pure blood
comes round to the left fide, it is mixed through the
foramen ovale, and through the breach of the feptum,
with a quantity of black blood, which is continually
accumulating upon it; and the fmall quantity of oxy-
dated blood is, if I may ufe the expreffion, drowned in
the general mafs.

That I may explain the point of its accumulating a
little farther, let me repeat, that even in a child which
has died on the tenth day of fuch a diforder, the heart
is crammed with dark-coloured blood: That in thofe
children which have lived two or three years under fuch
a diftrefs, the heart has been greatly enlarged: That in
a boy diffected by Sandifort, who died at fifteen, the
thing that was firft feen upon opening the body was, not
the lungs covering the heart and lapping over it, but a
large mafs, lying betwixt the lungs, oppreffing them and
                                        pufhing

puſhing them aſide in every direction. This was the pericardium covering a heart of enormous ſize, filling the thorax, and reaching almoſt to the firſt rib ; very little of the right lobe of the lungs, and none almoſt of the left, was to be ſeen ; the veins in the upper part of the thorax, viz. the ſubclavian and jugulars, were choaked by the preſſure, and much diſtended ; the heart itſelf was full of blood, and the coronary veins ſo turgid, that it reſembled a moſt minute and beautiful injection of the heart.

But it is moſt of all ſingular, that this heart was ſo enlarged, that the great veins, (which are indeed as re-ſervoirs for the right ſide of the heart), and eſpecially the upper cava, dilated along with it in ſuch a degree, that there was felt diſtinctly a pulſation in the neck by a ſort of back ſtroke every time the heart beat.

Still a child, even with a heart ſo ill organized, may ſtruggle through all the weakneſs and all the diſeaſes of childhood * for a few years, but they are years of com-plete miſery ; and ſtill, as is proved by much ſad experi-ence, the boy cannot live, but muſt die.

Another conformation, the ſtrangeſt of all, is that in which new parts are added to the circulating ſyſtem, as if with deſign to make it reſemble the heart of an amphi-bious creature ; for it happens ſometimes, that there is as it were a third heart interpoſed. For example, the two vena cavas end in the right auricle, the pulmonic veins enter into the left auricle and the right and left ventricles receive their blood from their auricles in the uſual way ; yet the right ventricle ſends out no pulmo-nary artery, the left ventricle ſends out no aorta ; but both of them pour their blood into a middle ventricle, and the arteries go out from it : and here, as the blood is fairly delivered by both ventricles into this third ven-tricle, and as the pulmonic artery and aorta both ariſe from it, there is, of courſe, a fair diviſion of the blood ; and of the quantity which ſhould be oxydated, exactly

* Sandifort attended a puer cœruleus, who, in addition to his chief diſeaſe, paſſed through the ſmall-pox and meaſles ſafely, and attained the age of fifteen.

one-half

one-half undergoes that change. This is somewhat like the heart of the Turtle; it is plainly the structure of an amphibious heart, a single heart; for though there be three cavities, yet are they single in their function; it is a single heart with half oxydated blood. Such a heart is sufficient for Amphibiæ, or for the foetus, but not for a child, which must breathe and have a double heart.

These are a few of the varieties of the imperfect heart; but the sufferings of children who are born with these imperfections, the marks of imperfect oxydation, and the manner of their life and death, was a chief motive for entering on this subject.

When the heart is so imperfect that the child lives but a few days, its sufferings are slight, and not lingering, so that we cannot mark them : They are not explained to us by any account of its inward feelings : They are all accumulated into one terrible struggle, in which we see the worst marks of ill oxydated blood.

The child is born well and healthy, it cries and draws its breath, it is removed from the mother ; the function of the placenta ceases, but there is no other to succeed it ; the child turns black in the face, struggles for breath, and is convulsed ; and without any apparent cause it seems in the agonies of death : But yet it lives, it becomes black all over the body ; the blackness never goes off except when it changes sometimes into a deadly ash colour. The child continues for a few days labouring under almost unceasing convulsions, which growing gradually weaker, it at last expires ; and while it lives, the heart palpitates, sometimes it throbs so, that it can be distinguished at a distance by the eye. Dr. Hunter, in the child which I have already mentioned, laid his hand upon the breast, and the throbbing which he felt there was terrible to him.

When the child has the heart so formed as to admit into the lungs even a very small proportion of blood, it struggles through the first years of life, and its protracted sufferings can be more easily observed. Then no mark of ill-oxydated blood is wanting ; every thing is the
                                                                    reverse

reverfe of health, or the natural appearance flufhed and florid of a growing child ; its colour is always dark, its motions languid and powerlefs ; it is cold; fo that the parents muft keep it carefully wrapped in flannels and furs to preferve any thing of vital heat ; its breathing is difficult and diftreffed ; fits come upon it at times ; and if the child has begun to walk, the leaft hurry, or fear, or quick ftep, even walking acrofs the room, brings a return of the fit : in which the extremities are deadly cold, the face black, the breathing one continued ftruggle, and the end of the fit is the obtaining of a degree of relief, which happens in a moft fingular way.

The coldnefs, the livor, the languor, the fainting, the ftruggles for free breathing, are all marks of ill oxydated blood. The convulfive paroxyfm is a fure confequence of the want of ftimulus and force, and of blood accumulating at the right fide of the heart. If, then, the child fall down in this paroxyfm, it is the very fureft proof that ordinary refpiration will not fave him from the ftruggle ; if during the fit he breathe fo that he recovers, and that prefently his ftrength, colour, fpirits, every thing, is in a degree reftored ; then is it plain that the refpiration during the fit, imperfect as it appears to us, is really more effectual than ordinary refpiration.

When we obferve which is the moft natural way of obtaining relief, and notice the very peculiar manner in which thefe children breathe, we fhall underftand why they are breathing beft when we believe they are hardly getting breath, and how they are recovering flowly when we think them labouring in the greateft danger. The child feeling the growing oppreffion at its breaft, if it be young, fignifies a defire to be turned upon its face ; if not indulged, it contrives to turn itfelf that way before its hard ftruggle begins. When the child begins to breathe hard, it drives out the air with a fudden exertion, and apparent pain ; he remains longer without refpiration than an adult could do ; his expirations are attended with a fort of fcream. What can this way of breathing mean ? To my apprehenfion it implies that

8

kind

kind of breathing which I have called forced refpiration, and no other plainly can ferve.

The ordinary refpiration, by which we draw in 40 cubic ounces of air, has failed ; the fit is approaching, becaufe that quantity of air will not fuffice. However rapidly the child breathes, however rapidly the heart palpitates, it will not do, becaufe there are but 40 ounces of pure air mixed with the whole of that great mafs which remains always in the lungs. Then the child, driven by inftinct, provides for the fulleft refpiration : it turns upon its face, that the weight may help to comprefs the thorax ; it forces with all its power, and feems to ceafe from breathing, and refrains a long while in that ftate, becaufe it is emptying and compreffing the lungs. Then its purpofe is accomplifhed ; the lungs are more emptied than in ordinary refpiration ; it draws in the largeft draught of air, utters a fort of fcream, feems quiet again ; and again, by preffing its breaft, and by contortions (convulfive like of its body), it empties its lungs at a diftant interval, and receives again the fulleft draught of air. It is this forced refpiration that brings into the lungs 70 cubic inches of air more than the ufual refpiration does. This, then, is three times more effectual than ordinary breathing ; and when a boy grown up to thofe years in which he knows the warnings of his diforder, and has found out this relief ; when fuch a boy by preffing upon the corner of a table, or by throwing himfelf upon the ground, prevents or alleviates his paroxyfms, in what way can it be but by practifing for a time this deeper refpiration ? preffing the cheft, forcing and compreffing the lungs beyond their ufual degree of collapfe, and fo obtaining a fuller draught, a draught of 110 ounces of air, to be mixed with the 110 ounces which muft always remain in the lungs ?

After half an hour of a kind of breathing, moft awful to behold, but much more effectual than common breathing, the child recovers flowly. The boy, when advanced a few years, knows how to prevent the fit ; but the child of two or three years old knows only how

to

to ftruggle with it : yet this ftruggle being a more effec-
tual breathing, the child is relieved at once from an
anxiety, and oppreffion, and throbbing, which precedes
the fit for many days ; the languor goes off, the heat in
fome degree returns, and the lips acquire a vermilion
colour and the fkin a higher tint, which laft for many
hours after the fit is gone.

In thofe children, again, which have the heart fo
formed that they may live not two or three years only,
but to the age of 15 years, it naturally happens that
the fymptoms follow each other in their courfe very
flowly ; and the ill oxydation of the blood in this its
flower progrefs it is very curious to obferve.

There is one thing in the economy of the fœtus very
fingular, viz. that while it is receiving much oxydated
blood from the mother, but a fmall portion goes through
the ductus venofus directly to the heart, much of it cir-
culates through the liver, and is fpoiled (we muft fup-
pofe). What then can this mean ? Surely the child, the
chick, the fœtus of every kind, needs lefs of this prin-
ciple of oxygene : the fœtus lives (if this be fo) like an
amphibious creature ; perhaps it has little oxydated
blood ; yet being totally deprived of that little, it foon
dies. Perhaps the fœtus, living the life of an amphi-
bious creature, does not want alfo that peculiar tenacity
of life which characterifes that clafs ; for the ftruggles
and fufferings which a weakly infant endures, before it
parts with life, are matter of obfervation even among the
vulgar. For this reafon I believe it is that children,
having a heart fo ill arranged that abfolutely they cannot
live beyond the years of puberty, yet during the firft
year feel no complaint, and feem thriving and healthy ;
the vegetating life of a fucking child faves it from all
dangers of hurried refpiration and rapid pulfe.——But
when it leaves the breaft ; when it begins to ftir and
move ; when its blood, moving languidly, begins flowly
to accumulate at its heart ; when the properties of its
living fibres change, fo as to require a fuller fupply of
oxygene from the blood—then the ill colour, languor,
palpitations, flighter fits, and all the marks of its
                                                    difeafe,

difeafe, begin; and often its colour gradually changes, and it becomes the puer cœruleus, or livid child, before we can perceive by any other marks how dangerous a condition it is in.

In one child * the firſt year had elapſed before the very flighteſt of thoſe complaints came on, which ended in death at a very diſtant period of 15 years. At firſt its finger nails were obſerved to be livid, yet not continually; the colour varied, but ſtill the nails were unnaturally livid, ſo as to alarm and ſurpriſe the parents; but there was as yet no reaſon to deſire advice. The child feemed healthy, began to uſe its legs, and in the ſecond year it walked alone.—Next it happened, that one day after being forced to take a medicine, not without ſome reſiſtance, his face was on the following day freckled with red ſpots, which ſoon changed to a livid hue. Now the laſſitude and chillneſs came on; motion or exerciſe were more and more oppreſſive to the boy; till at laſt when he fatigued or hurried himſelf, the hands and feet became livid, the mouth and tongue became almoſt black, and laſt of all thoſe fits came on in which the whole body becomes livid or black.

This is the progreſs of this darker colour of the body; but his other complaints alſo advanced with a very ſlow and regular pace. He increaſed in ſtature, his appetite was good, he complained of great laſſitude, of head-ach, with a ſort of gravitating pain, of anxieties, eſpecially during the winter months, and of ſuch extreme coldneſs, that neither fire in winter nor ſummer's ſun could warm him; he never felt heat except when juſt wrapped up and newly laid in bed.

Now the blood began to accumulate; the ſtruggles of the heart began; and fo terrible were the throbbings of his heart at times, that they might be ſeen or even heard. Actual faintings ſucceeded; the poor boy, now eleven years of age, knew that he was to die; he ſaid, that " no one could know or cure his illneſs, and that no one could imagine what feelings he had here at his heart."

* Vide Sandifort.

                                        . Motion

Motion was now quite impoſſible; upon the ſlighteſt effort ſaliva flowed from his mouth, a fainting fit enſued, and he continued for a little while blind. All that he was wont to delight in was now indifferent to him; he could not move; his face was turgid, his eyes prominent, his feet were ſwelled with an œdema, his eyes dead and heavy, expreſſive of ſome inward diſtreſs; when he was put to bed his anxieties were very great, and thus he died a ſlow and miſerable death.

Sometimes a child wants ſpirit or ſtrength to ſtrive againſt the laſſitude of this diſeaſe. A girl under Vaſalva's care lived to her fifteenth year; but from her infancy, from her very birth, ſhe had lain in bed, partly on account of ſickneſs, but chiefly on account of extreme weakneſs. She had a ſhort and difficult breathing, and her ſkin was tinged all over with a livid colour; her quiet ſtate ſaved her from the ſuffocating paroxyſms; but her heart was juſt like all the others, the foramen ovale open, and the pulmonic artery cloſed.

Theſe, then, are the marks of ill-oxydated blood: a livid colour, coldneſs which nothing can remove, oppreſſion and anxiety of the breaſt, palpitations and difficult breathing; and when the blood is by paſſion or motion hurried too faſt towards the right ſide of the heart, then come fits, which laſt a longer or ſhorter time in proportion as they have been long delayed, and which end in death. And laſt of all, I would rank among theſe conſequences an imperfect nouriſhment, for all the boys have been ſmall, moſt of them particularly ſlender; and one boy eſpecially, of fifteen years of age, is mentioned by Hunter, who, in reſpect of tallneſs, was juſt what you ſhould expect at his years, but ſlender to a wonderful degree; not as if waſted by conſumption, but as if by natural habit. His form was quite ſurpriſing, ſo that Hunter could give no idea of his ſhape, otherwiſe than by comparing his body with that of a Greyhound; and his legs, he ſays, put him in mind of thoſe of a Crane, or ſome tall water-fowl.

The conſequences muſt be alike, whether it be that the heart ſends no blood towards the lungs, or that the

lungs

lungs cannot receive that blood ; and the malconforma-
tions of the heart are hardly more frequent than those
of the lungs ; and both, we may be well assured, are
infinitely more frequent than we suppose ; especially
when we observe how many children die suddenly, dis-
coloured, and in convulsions ; and how many of those
advanced in years have lived very miserable with com-
plaints in the breast.

A young man of twenty-four years of age, by birth a
Pole, and at the time of his death a soldier in the Ger-
man service, had been continually oppressed from his
cradle upwards with difficult breathing and anxieties at
his breast. He had been three or four times relieved
from slighter complaints of the breast ; but at last the
bleedings and demulcent medicines failed : he lay ill in
the military hospital two months, where of course his
complaints were correctly known. He had none but
the slighter degrees of difficult breathing ; when one day
sitting up in bed he suddenly expired. Being opened,
the right side of the lungs was found to be totally want-
ing ; not destroyed by disease, as we have often seen,
not oppressed by water nor eroded by pus, but entirely
wanting ; a peculiarity which he had from his mother's
womb, for it was attended with a peculiar arrangement
of the vessels. On the right side there was no vestige
of the lungs, not even the smallest button to mark
where they might have been ; there was no branch of
the trachea for the right lobe intended by Nature, but
both the legs of the trachea plunged into the left lung,
which was large : There was no forking of the pulmo-
nary artery to give a branch to the right side, but the
whole trunk of the pulmonic artery plunged into the
left lung.

But if one should suspect that there might have been
once a right branch, the lungs destroyed, and the mouths
curiously united by that mucus which the membranes of
the viscera, and the pleura especially, throw out when
inflamed ; there are still other cases which must remove
all our doubts, especially that of a young man *, who

* Under the care of Dr. Heberden.   Vid. *Acta Vendobonensis*.

died

died in a very lingering way, and in whom before his death there was plainly perceived, along with his flight anxieties, a pulfation in the right fide of the breaft. Upon opening his body, there was found in the left fide neither lungs nor heart; nor, upon the moft careful examination (feeking for the wafted lung), could there be found the fmalleft remains of lungs, bronchiæ, pulmonic arteries, or the flighteft evidence that any fuch parts had ever been. But the fureft proof of this remains behind, for the heart ftood in the right fide of the cheft; it ftood perpendicularly, quite upright like a Dog's; it gave out a right pulmonic artery, but there was not even the fmalleft veftige of any artery having been appointed for the left lobe. We muft not fay, yet his cheft may have been full enough of lungs and heart, and he may have had a well-oxydated blood; in which cafe it was no very dangerous derangement that his lungs were all on the right fide, more than if his liver had been on the left. But let us notice that the aorta was extremely fmall; the diameter of the aorta is the true meafure of the blood which is received from the lungs. Where the aorta is fmall, furely the lungs are not good, nor the fyftem fully fupplied with oxydated blood.

We alfo know that though the veffels of the lungs themfelves may be natural and well arranged, the lungs may ftill be amifs; they may want the proper ftructure of cells in which the blood fhould be expofed; they may be encumbered with tumours arifing out of their fubftance, by which they will be prevented from dilating. One is pleafed to find in old authors good defcriptions of difeafes which have remained for ages unknown; and among thefe I reckon that of the celebrated Spindler; whofe defcription I admire as much as that of any fucceeding author.

The child of a certain prince having died after a few days of great fuffering, Spindler opened the body, and found all found and right, except that there were feated upon the two lungs two tubercles of a variegated red colour, as were the lungs themfelves; which tumours, no doubt, hindered the paffage of the blood, which he

expreffes

expreffes with a correctnefs in refpect of phyfiology quite
unknown in thofe times.   " Quæ vomicæ procul dubio
hujus afphyxiæ caufæ extitere denegata circulatione ex
dextro in finiftrum cordis ventriculum."   His defcrip-
tion of the difeafe fo long before it was properly under-
ftood is curious : " During the eight days in which the
child lived, it had never cried ftrongly nor clearly, had
never fucked, had never been regular in its bowels,
breathed as if its fides had been blown up ; it was fud-
denly feized with a fit, which feemed epileptic, foon
went off, but foon returned ; the whole face and body
became firft red, then of a copper colour ; the breathing
was interrupted, the eyes immoveable, the feet and
hands lay almoft lifelefs ; it fuffered at leaft a hundred
of thefe fits before it expired."

To enumerate thofe cafes where a defect of the lungs
were the confequence, not of malconformation, but of
difeafe, were a bufinefs quite inconfiftent with my de-
fign ; yet I wifh to record thefe two.—Firft. It has been
long obferved, that by long continued fuppuration, the
lungs are often fo wafted that not a bud or particle of
them remains : fometimes thefe patients furvive, drag-
ging on a languid and miferable exiftence, enjoying no
freedom, life, nor fpirits ; and the caufe of their frequent
ailments is difcovered at their death.   The lungs alfo
may be thus compreffed even by the mere preffure of
water within the cheft, which has caufed fuch a fub-
fiding, or rather abforption, of the lungs, without any
ulcer of their furface, that one lung has been oppreffed
till it became no more than three lines in thicknefs ; and
indeed it was not eafily found : fo Haller fays in his
Commentary upon Boerhaave.   But of all the ftrange
things which Haller or any man has ever related, what
he tells in the following words is the moft incredible ;
at leaft it is fo improbable as to be incredible : " A
man having died of a lingering difeafe occafioned by
a fall, the left lobe of the lungs was not to be found ;
that fide of the cheft was full of a coagulable ferum ;
but the afperia arteria and large arteries and veins (a
thing which I never could have believed, had I not feen
                                                        it

it myself) opened with gaping orifices into the cavity of the thorax, as if they had been cut acrofs; fo that it was very hard to conceive what had prevented the blood from pouring out." Haller, p. 34.

Secondly, In the peripneumonia notha there is not merely an inflammation of the pleura, as the name exprefies, but of the lungs themfelves; and it is not from inflammation, pain, fever, or acute fuffering, that they die; but becaufe the lungs are entirely crammed with blood; the heart can no longer move : they are not fenfible of their dangerous ftate, but are fuffocated in a moment, and die without a groan. It feems more frequent in other countries than in this, though no country is exempted. When this difeafe comes upon a place, it comes with all the frequency and deftruction of an epidemic difeafe; and the fudden unexpected deaths are terrible. Vafalva found an old gentleman going abroad in the morning, and prevented him, queftioning him about his complaints, which he himfelf thought very flight : but Vafalva gave notice privately to the fervants to expect nothing better than their mafter's death; and notwithftanding all affiftance, he was that very evening dead.

The pulfe is weak, the cough flight, the difficulty of breathing more anxious than painful; the face funk in the features and flufhed, or rather of a lurid colour, except when it is cadaverous, pale, and fallow; the fuffocation is fudden; the lungs have, as Morgagni exprefies it, a liver-like, folid confiftence; they have no longer the cellular appearance of lungs, for their bronchiæ are crammed with blood; their common cellular texture is alfo full of exuded blood; they are denfe, folid, very heavy, and black, and they fink in water like the lungs of a fœtus. The heart is fo curbed in its actions, that it gives but a fmall, feeble, and trembling pulfe; and even in a few days (as in the fœtus having an imperfect organization) the heart is wonderfully dilated and enlarged, and filled with fluid and grumous blood. Haller laments the death of friends by this terrible difeafe, and efpecially of his own fon,

" whofe

" whofe body he gave to be opened by thofe fkilled in diffections."

PERHAPS the heart may be too fmall for the fyftem to which it belongs ; and this, I doubt not, had been the cafe with that boy in whom Kerkringius found it fo fmall, that though the boy was nine years old, the heart (*i. e.* the ventricles) was no bigger than that of a fœtus ; and the whole heart, auricles, ventricles, and all, was no bigger than that of a child born at the full time. But in proportion as the heart was fmall the veffels were large, not at all aneurifmal, but of fuch a fize, and fcarcely of fuch a fize, as might fuit the heart of a boy of nine years old. This boy had for five years been hectic, that is to fay, he had been troubled with no formed difeafe, but with continual diftrefs, anxiety, weaknefs, and quick pulfe. This heart was plainly inadequate to the functions of any fyftem ; but the cafe is too flightly fketched for us to find any decided marks of ill oxydated blood.

But that the heart may be too big for its fyftem, is a melancholy fact ; for when it becomes relaxed, it en-larges, and as it grows in bulk lofes in power. That the heart is enlarged merely by weaknefs, by fubmitting to dilatation, by wanting fufficient power to free itfelf of accumulating blood, is very plain ; for in the plague, in low and peftilential fevers, even in nervous affections, it fometimes enlarges, and this enlargement from a tem-porary becomes a mechanical and fixed difeafe. How of-ten do we read in the preface to fuch diffections of en-larged heart, " he was of a melancholy temperament, of a flow and fedentary life, oppreffed by misfortunes, and ftruggling with vexations and grief." In the angina pectoris, which is in its firft attack no organic difeafe, we often find the dilated heart pale and tender, fo that the fingers may be pufhed through its flefh.

While the heart gradually enlarges, the fyftem changes, and accommodates itfelf to its powers. There is little diftrefs ; often we find a heart enlarged to a degree fuch as we never could have fufpected before death. But flowly there is formed fuch an accumulation of ill-oxy-
dated

dated blood as oppreſſes the vital powers, and chokes the motions of the heart, and draws after it thoſe other diſorders which are already in part explained.

Of the mechanical conſequences which follow the enlarged heart, thoſe chiefly attract our attention which prevent the due oxydation of the blood.

Firſt, the dilatation of the heart draws after it a dilatation of the great veins, ſo that they become reſervoirs as it were; and the auricle and veins both enlarge ſo, that the office of the auricular valves is quite loſt; the veins feel, or rather the column of blood in the veins feels the back ſtroke from the heart, and it is perceived even in the neck by a ſtrong pulſation.—Secondly, Theſe veins, and this monſtrous heart, ſo fill the cheſt, prevent the blood of the neck deſcending, and ſo puſh aſide the lungs, as to compreſs them to the laſt degree that is confiſtent with life.—Thirdly, The enlarged heart accumulates much blood in the ſyſtem which before did not exiſt, and that blood dark coloured and unfit for the purpoſes of life. The proportion betwixt the great maſs of ill oxydated blood lingering in the veins and about the heart, is increaſed ſo very greatly, in oppoſition to the very ſmall quantity which can now be oxydated in the lungs, that ſuch perſons are expoſed every moment to the greateſt dangers; and the leaſt accident which draws out more black blood from the veins, and hurries it towards the heart, quite overcomes them. Then there is an agonizing and fearful ſtruggle; the heart often ſtruggles, and often frees itſelf; but in moſt caſes thoſe who live in this condition do, after many eſcapes, fall down ſuddenly dead. " A very learned man having this enlargement of the heart while he was ſtill walking about in his ordinary health, his heart would often ſtop for three or four pulſations, as if ſtruggling with its load, velutque expulſionem moliretur *."—Fourthly, In this enlargement of the heart, although ſometimes there is a perfect and equal pulſe, though ſometimes alſo the diſeaſe ſcarcely ſhows itſelf

* Veſalii, lib. i. cap. v.

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till very far advanced, and after many years of flow in-creafe; yet the heart being continually loaded, and often ftruggling, cannot free itfelf at one ftroke of all its blood; then, ftroke fucceeding ftroke in a confufed irregular way, there is a weak, irregular, intermitting, fluttering pulfe.—Fifthly, But Nature, wonderful in her ways, fometimes finds relief from this in the regular conftitution of thefe parts; for while the heart dilates, and becomes more powerlefs as it dilates, the aorta (being but poorly filled) contracts in proportion as the heart dilates, and accommodates itfelf to the fmall quantity of blood which fuch a heart can give out; and thence the wonder fometimes expreffed at finding an aorta extremely flender joined often to an enormous heart.

" In opening the body of a fhoemaker, fays Morgagni, whofe heart was wonderfully enlarged, feeming as if you had joined two hearts, what chiefly ftruck us was the fmallnefs of the aorta, more fuitable to a delicate woman than to a man of good ftature as this was. The aorta, from its paffing under the diaphragm to its great divifion in the pelvis, was very fmall." This Morgagni firft of all believed was owing to fome ftricture at the dia-phragm; for the aorta did not pafs as ufual under the legs of the diaphragm, it paffed through a peculiar hole; but he found this tendinous hole quite large and free. Still he believed that all the diforder of the heart arofe from the contraction of the aorta, and that again from the crooked pofture in which thofe fit who are of this trade. But that often the artery is contracted in favour of the enlarged ventricle, I am able to prove better than by this cafe of Morgagni's. In the firft place, the dif-torted pofture of his fhoemaker can have no effect; for we muft not forget how limber, flexible, and free from difeafe, the aorta is in thofe who have the unhappinefs to be deformed, and in whom the aorta follows the fpine fo clofely, that often the bones almoft meet in their diftortions, and hide it. I have cut out thefe aortas fometimes and laid them on boards, to fhow the ftrange angles which they make with fuch perfect fafety. Next I have to obferve, that where the auricles and ventricles

ventricles dilate in old people, the aorta alfo dilates : for there the aorta is old, partly offified ; its mufcular coat ftiff and incapable of action ; it is, in fhort, as weak as the heart itfelf, and yields along with it to the accumulating blood. But in younger men, the aorta being mufcular and ftrongly contractile, this phenomenon enfues : that as the heart increafes in fize and weaknefs every day, it ftruggles with lefs effect againft the accumulation ; its pulfes are imperfect ; it delivers lefs blood into the aorta ; the aorta, lefs perfectly filled, is not excited by the fame power which formerly filled it and kept it full : therefore it contracts gradually and flowly ; it preferves ftill its healthy conftitution ; it is limber, pliant, and found, in its mufcular coat. In fhort, this doctrine of Morgagni's implies only a ftationary condition of the aorta ; this other theory implies an active contraction. Now Morgagni's fhoemaker was a portly man, but his aorta was fmaller than a woman's. Even this cafe of his own implies an actual contraction ; fince, had this man's aorta continued ftationary, it muft have been ftill the aorta of a man of good ftature, joined to a large heart. But a perfect proof is this : I have a heart which it would not be eafy to defcribe ; it is not only as big as two hearts joined, but I may fay, with Bartholine, " ut fæpe in Bobus non magis fit aut ponderofior." The heart is bigger actually than an ox's ; it is bigger, I think, by the whole fize of its two great auricles ; it is injected with wax ; it weighs more than four pounds, and is two feet in circumference ; but the aorta is no bigger than the femoral artery at the groin, very ftraight and even in its diameter, very flender, and with coats which plainly have been very thin and fuitable to fuch an artery. Here the artery is equably and fairly contracted to one-fourth of its natural fize, which fuppofes a natural and found condition of its coats : And one of two things muft have happened, either the artery muft have contracted firft, oppofing the heart and caufing it to enlarge ; but then its violent contraction, like the urethra contracting in oppofition to the bladder, would have thickened it into a ftrong mufcular tube :

or,

or, fecondly, the artery muft have contracted gently
and gradually in favour of the dilatation and weaknefs
of the heart ; and then it would remain (as this artery
really was) very foft, delicate, and limber. I fufpect
alfo, that where the aorta is enlarged, there is required
a ftrong, fmall, and mufcular heart ; becaufe I have
an aorta enlarged to a very great degree, the heart being
extremely fmall. Thefe accidents will be noticed chiefly
where, in young people, there happens fuch difpropor-
tion of mufcular power betwixt the heart and its veffels ;
but in the aged, all the parts are but too much difpofed
to difeafe, and the whole will enlarge.

Thefe, then, are the chief confequences of that en-
largement of the heart which often fo fills the thorax
and loads the diaphragm, that it falls down under the
weight of the heart: then the heart is felt lower than
natural ; and the diforder is named by moft authors the
prolapfus cordis. In a young man of twenty years of
age, the moft miferable creature I ever faw, I have felt a
prodigious heart beating as if quite in the abdomen : at the
pit of the ftomach the pulfation was particularly ftrong ;
it muft have been miftaken for an aneurifm of the cœliac
artery, had not the heart been felt beating from the
navel almoft to the collar-bone.

Whether we are to allow, that the blood fometimes
does coagulate and form polypi in thofe enlarged hearts,
I believe no man in the prefent ftate of our knowledge
will venture to decide. That the blood fhould coagu-
late thus firmly, while within the body, and that not in
a corner of the circulating fyftem, but in the heart
itfelf, where always there muft be fome motion, it is
not eafy to believe ; nor that fuch coagulations fhould
remain there, be wafhed pure by the current of blood,
fo as to have a leathery colour, and to be firm and
ftrong ; that fuch coagula fhould entangle the valves and
columnæ carneæ, fhoot up into the great veffels, and
hinder the movements, and clofe, in fome degree, the
openings of the heart, is quite unlikely : yet if there be
uch a thing, this muft ftand as the defcription of a
folypus of the heart. I incline then rather to the opi-

nion

nion of the able and diligent Kerkringius, who calls them pſeudo-polypi, baſtard polypi, mere clots of blood; of which he produces drawings from the pulmonic veins, the liver, the heart, the brain, &c. wherever great veins are.

That when the heart is monſtrouſly dilated, clots may be formed in it, very large, filling all its cavity, but ſtill happening chiefly in the moment of death, or during its ſlow approaches, I believe from what Veſalius relates; who, " in the heart of a nobleman, found two pounds of a dark coloured fleſh; upon which lump, the heart, of monſtrous ſize, was extended like a gravid uterus." But this black fleſh, ſince it was unconnected with the walls of the heart, was a mere clot; which, had it come really from the womb, Veſalius would have called a falſe pregnancy, an ovum deforme, or what the vulgar call a mole.

This, and all the leſſer polypi, thoſe ſtrings of coagulum which entangle the columnæ, and ſtretch upwards into the veſſels, are really formed in the moment of death. But it is not to be forgotten, that many of the moſt eminent men have thought quite the reverſe of all this. Polypi, when firſt noticed, ſeemed a ſtrange and awful and frequent cauſe of death. Having once believed and wondered at ſuch a thing, people did not even like to be diſabuſed; and when Kerkringius called them pſeudo-polypi, the whole phyſicians, like a hive of bees, ſwarmed out upon him at once. Tulpius, Malpighi, Pechlinus, ridiculed this opinion. Pechlinus was ſo offended, that he could not refrain himſelf from low and mean language. " True polypi there certainly are, ſays he, but theſe polypi of Kerkringius are indeed pſeudo-polypi, and every blind ſhaver knows them abundantly well;" (tam eſt vulgaris et lippis tonſoribus notus). " The ſhop-boys, ſays Pechlinus, make ſuch polypi, by pouring vitriolic acid into the veins." Yet with all his bitterneſs, Pechlinus has not proved, to my ſatisfaction, either by his arguments, or by his caſes, that polypi exiſt; but he made many believe him, for the ignorance of that time is very ſingular. Dr. Petrus
Ruſſe

Ruffe tells us, that he had once found a polypus in the longitudinal finus of the dura mater, of a quarter of a yard long: " Let this be put down," fays he, " as one proof at leaft that polypi are fometimes found higher than the nofe." What muft have been the confufion of their notions, who could thus jumble the ideas of a polypus of the blood-veffels and a polypus of the nofe?

They even miftook fuch clots for living animals. Dr. Edward May fent from England to the celebrated Severinus a defcription of an Eel which he had found in the cavity of the heart. He entitles it, with fome propriety, " Hiftoria mirabilis anguis bifidi." It is, indeed, a wonderful ftory ; they defcribe head and tail, and all fairly, as if it had been *bona fide* a living creature ; and tell us how its head was fticking to the infide of the heart (where you may fuppofe it was biting), and how its body was very white and very ftrong, and its arms or tails, I do not know what to call them, red. But what amufes one moft of all is the important air of thefe communications betwixt Severinus and Dr. May ; and then Severinus, warning his pupils againft incredulity, and telling them, " that though wounds of the heart are really mortal, yet ulcers of the heart certainly are not mortal ;" by which he means, that while the Eel was alive it was continually biting the heart *. In fhort, from thefe things, we perceive that we need not look into books for any fatisfaction on this delicate point ; that we muft depend upon ourfelves, and make a better ufe of all future occafions ; for unhappily there are no good hiftories attached to thofe diffections in which the coagula have been likeft to thofe of a long formed difeafe †.

The heart, which is fo often dilated by weaknefs, is

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* It is certain enough that fmall worms are found not only in the œfophagus, but in the aorta too, of Dogs and other animals. Vid. Morgagni's *Adverfaria*. For plenty of real worms in the heart, producing St. Vitus's dance in boys and hyfterics in girls, vid. *Sckenkius*, page 272.

† A cafe liker this difeafe than almoft any other, is a very melancholy and affecting ftory of a Mr. Holder, an apothecary. Vid. *London Medical Journal* by Simmons, and *London Medical Communications*.

sometimes reduced in size by an increase of strength and
action. It becomes dense, firm, thick in substance, but
small in its cavity; it appears to be dilated without, but
is, in fact, contracted within. This thickening of the
walls of the ventricles is what I cannot understand,
though I have cut many such hearts with the utmost
care. There is no ossification of the valves, no straiten-
ing of the aorta, nor any other obstruction to excite the
heart. There is no enlargement of the auricles, no di-
latation of the veins, no disease of the arteries, nothing
appears but a thickening, and enlargement, and con-
densation of the walls of the ventricles, a proportionate
enlargement of the columnæ carneæ, and a proportionate
narrowing of the cavity of the heart itself. Upon open-
ing such a heart, one would almost pronounce it natural.
If one should speculate upon its peculiarities, he would
(finding the heart strengthened, and its valves and vessels
all sound) pronounce that it would cause rather a vi-
gorous circulation and strong health: yet I shall never
forget the miseries I have seen patients endure from having
such a heart. They have often a full and bloated habit
of body (at least so I have chanced to observe), a pulse
weak at all times, but trembling, and hardly sensible,
when a fit of difficult circulation approaches; then the
pulse vanishes, the patient sometimes faints; the anxie-
ties, oppressed breathing, languid pulse, actual faintings,
and all the intermediate conditions less than fainting,
but like it, and infinitely more miserable, make their
chief sufferings. After struggling long under this disease,
the patients grow languid for a few days, often become
dropsical, and then die.

The variety of symptoms which those suffer who have
this simplest of all the diseases of the heart is very sur-
prising, and puts to nought all our conjectures about
certain signs indicating particular diseases of the heart.
We cannot be surprized that in great enlargements of
the auricles, or vast aneurisms of the aorta, or in those
enlargements in which something like polypi are
found, and where, as Mr. Holder often said of himself,
the circulation seems to go on for a time in one corner,

as

as it were, of the heart; in all fuch cafes, we cannot wonder at there being heard noifes like the rufhing of water.   But how fuch fhould be heard in this thickening of the heart, I cannot conceive: yet it is certain that one gentleman, whofe difeafe came upon him all at once, and while perfectly at reft, with the fudden fenfe of fomething burfting within; who had moreover for feveral years a palpitation which could be felt outwardly, and a plunging noife, which at times the by-ftanders could hear very loud; who died in the end in great diftrefs,—had yet none of thefe offified valves, enlarged aorta, nor other organic affections, which there was fo much reafon to fuppofe, but merely this thickening of the fubftance of the heart.

Among the difeafes of the heart we may reckon the dilatation of the aorta, a difeafe more frequent than all the others, and more dreadful.   It is a difeafe more frequent in the decline of life; it is then a difeafe of weaknefs; it arifes from a caufe quite different from that which is commonly laid down.   The celebrated Dr. Hunter believes that it arifes from that predifpofition or weaknefs which naturally belongs to the form of this part, viz. a fudden angle of the artery, expofed in the moft direct manner to the whole force of the heart.   Dr. Hunter alfo believed, that no fooner is Nature fenfible of this danger, than fhe feeks to prop up the artery; and for this end thickens its walls till it offifies by flow degrees.   Haller's theory is different from this, and comes nearer to the truth; for he makes thefe fcales of offification not the confequence, but the caufe of the difeafe.   He fays, the artery becoming fcaly, and partly offified, no longer yields to the force of the heart; and the heart thus excited to a higher action is itfelf dilated, and at laft forces alfo the aorta.   In truth neither of thefe is the true theory; but the aorta in aged perfons beginning to offify, has its middle or mufcular coat annihilated, and its outer and inner coats thickened, by the fame procefs.   Its mufcular power is loft; it is no longer capable of withftanding, much lefs of feconding, the ftroke of the heart by a fecond ftroke; it ceafes to

act,

act, fuffers itfelf to be dilated, and in a few years grows into a dreadful difeafe. I never faw an old aorta without fome fpecks of offification, or rather of calcareous concretion, nor an aorta fo affected which was not dilated in proportion pretty nearly to the degree of this thickening and offification; at which we need not wonder, fince we find not a bone (as it is ufually called offified aorta), but a vile calcareous concretion fubftituted to its mufcular coat. Nature is not at this time, as Hunter fuppofed, building up and ftrenthening the walls of the aorta againft this difeafe; but taking down flowly that fabric which has lafted its appointed time.

However produced, it is an awful difeafe; for every organ, when once deranged, efpecially if it be one as active as this is, never ftops in its courfe; and this efpecially ends early or late in fome terrible kind of death. Sometimes, increafing in fize, it deftroys all the furrounding parts and burfts within. Sometimes it burfts into the cheft, and then the patient drops fuddenly down; fometimes into the trachea, and then the caufe of the fudden death is known; for the patient, after violent coughings and ejections of blood by the mouth, expires. Sometimes it beats its way through the ribs, deftroys the vertebræ, affects the fpinal marrow; and thus the patient dies a lefs violent or fudden death. Moft frequently, the tumour rifes towards the root of the neck, is felt beating there, deftroys the fternum, burfts up the ribs, diflocates and throws afide the clavicles, appears at laft in the form of a great tumour upon the breaft, beating awfully.—A dreadful ftate! and with nothing to keep in the blood but a thin covering of livid fkin, which grows continually thinner, till, burfting at laft, the patient expires in one gufh of blood.

But Nature can feldom bear all this diftrefs; the patient dies before this awful fcene commences; for the aorta often fo fills the cheft, fo oppreffes the lungs, chokes the trachea, and curbs the courfe of the defcending blood, that the fyftem, with a poor circulation of ill-oxydated blood, is quite exhaufted! And thus,

though

though the patient is faved from the moft terrible fcene of all, he fuffers great miferies : he feels fharp pains paffing acrofs his cheft, which he compares with the ftabbing of knives and fwords ; terrible palpitations ; often an awful fenfe of finking within him ; the found within his breaft as if of rufhing waters ; a continual fenfe of his condition ; fudden ftartings during the night, and fearful dreams, and dangers of fuffocation ; until with fleeplefs nights, and miferable thoughts by day, and the gradual failing of an ill-fupported fyftem, he grows weak, dropfical, and expires.

How, except by attributing them to fome peculiar weaknefs, to fome inward predifpofing caufe, fhall we account for all thefe terrible difeafes of the heart ? Albertine afcribed them fo entirely to the paffions of the mind, that he gives this as the chief reafon why in the lower animals * fuch accidents are not found. This is ftrange philofophy ; for who does not know that the human paffions are remarked only becaufe they fhould be under continual reftraint and controul ; while thofe of animals pafs thus unnoticed by Rammazini, only becaufe they are wild and furious, and we do not expect that they fhould be reftrained. The wild and ungovernable fpirits of animals would produce fuch difeafes furely, if fuch caufes could ; but whether they do produce them, neither Rammazini nor any of us know ; we are too carelefs of this kind of diffection.

Often, as I have explained, thefe complaints lie dormant for years, till on fome violent exertion the patient begins to feel them ; and when queftioned by his phyficians, being himfelf alfo extremely anxious to recollect the caufe, and always willing to fatisfy his phyfician, he remembers fome violent exertion, fome paroxyfm of paffion, fome fit of coughing, or fomething even lefs important than all this ; and tells how from that day he does not think he has enjoyed an hour of health.

That thefe diforders will arife from too violent exer-

* Had Rammazini never feen a Dog enraged, nor a wild Bull, nor untamed Horfe, nor a Cat with its back up ?

tions,

tions, independent of all predifpofition, we have every reafon to believe. Sometimes from blows, more frequently from fhocks or falls (for I have formerly noticed how little there is, except its veffels, to fupport the heart, or hang it within the cheft); but moft frequently of all have we reafon to fufpect thofe kind of exertions which are accompanied with a rapid pulfe and hurried refpiration. Of this kind I muft furely reckon all exertions difproportioned to the ftrength, and moft of all in the time of weaknefs and convalefcence. Do we not obferve how in fcurvy, upon the fmalleft exertion, the men drop down dead? how when a fhip is in danger, and they are pumping day and night with a weakly crew, thefe alfo fall down dead? Do we not often remember, that after fevers young Men, having made rafh exertions during their ftate of weaknefs, have brought upon themfelves this dreadful difeafe? Do we not fee that boxers, horfe-jockeys, and all the tribe of athletics, cannot make thefe exertions unprepared? And what is their courfe of training, but a fpare diet of generous food, with regular exercife, and gradual exertions; till, at laft, the two great functions of refpiration and circulation accompanying each other, are brought to the higheft pitch; and the man become capable of exertions, before impoffible or dangerous; now familiar and eafy to him? For examples of this danger, let thefe fuffice: A delicate man, little accuftomed to fatigue, having alighted from his horfe and tied it carelefsly, it efcaped; and all day long he chafed it, till, quite exhaufted, he was forced in the evening to give over, breathlefs and palpitating, a hundred times during this vain purfuit. From that day he never had one moment's comfort. In about a year after two throbbing tumours appeared upon his breaft; and, in the courfe of the fecond year when he came to me, thefe tumours covered all the breaft, throbbing in a moft alarming degree, each of them bigger than two fifts. At this time he had walked with tolerable eafe three miles to fee me; but in lefs than four months he was dead, having lived in the greateft mifery.

When I cut out the heart, I took alfo the fternum

along

along with it. I found an aneurifm of the aorta filling
all the cheft, two fair round holes betwixt the cartilages
on each fide of the fternum, by which the two tumours
were filled; the ribs and fternum were not eroded, but
the intervals betwixt the cartilages dilated; the two tu-
mours were, when the fternum was cut away, like two
great flat cups, cymbal-fhaped, one a little larger than the
other, and each capable of containing about a pound of
blood.

It has been known to happen, that a young man, tra-
velling on foot too far, has died in a few days of a pro-
digious enlargement, with pulfation of the heart. But
the cafe which comes nearest to that which I have juft re-
lated, is that of a man about 47 years of age, who had
fallen into the hands of robbers. Thefe men, unwilling
to commit direct murder, carried him into an unfre-
quented place in the foreft, and there tied him to a tree.
Senfible that no human ear could hear his cries, he made
the moft violent ftruggles, but without fuccefs. At the
diftance of fix hours he was found by a hunter acciden-
tally paffing that way, and faved; but not long, for his
ftruggles had produced an aneurifm of the aorta, of
which he died. Upon opening his body there were found
two aneurifms; one in the arch of the aorta, and one in
the left fubclavian artery.

The many cafes in which aneurifms feem to proceed
lefs directly from ftrains, blows, falls, and other mif-
chances, I will not ftop to explain; for a thoufand fuch
examples cannot prove that there did not exift an abfo-
lute predifpofition in each individual cafe. But as I began
with reprefenting the marks of ill oxydated blood in a
child, I fhall conclude with reprefenting the condition
of a man, which, even by a regular hiftory, could no
be reprefented more faithfully than in this fingle cafe.

I attended, fays Morgagni, the moft excellent Marqu
Alloyfis Pallucci, commander of the Pontifical forces a
Rome; a man who deferved a longer and a happier lif
His difeafe was an aneurifm in the breaft: he cou
neither lie down, nor go to ftool, nor take nourifhmen
but almoft inftantly a paroxyfm was brought on, whic
                                        threaten

threatened inftant fuffocation, and fometimes feemed like death itfelf. He never went to bed; he continually refted on a chair to avoid all motion; but inftantly upon the attack of difficult circulation, he would leap from his feat, and run to the open window, in hopes of breath- ing there more freely: yet even there he was ufed to draw his breath with a ftertor, his face was quite livid, he paffed his urine and feces without confcioufnefs; often the breathing was fo very difficult, fo interrupted, that even the fnoring ceafed, and he feemed dead, and fell forwards, apparently lifelefs, into the arms of the two fervants who continually fupported him on either hand. This was the degree of his diftrefs.

But after all thefe dreadful reports of difeafed heart, muft it not be a comfort for us all to know, that often the moft fimple affections, fuch as we call nervous, 'from peculiarity of conftitution, or from ill health, refemble thefe organic difeafes, fo that all the phyficians on earth could not pronounce upon the cafe? In fhort, often thofe which appear to be at firft the moft awful difeafes, turn out in truth the moft trivial and temporary. Palpita- tions and quick breathing are the moft ufual figns. Pal- pitations, fays Sckenkius, may arife from tubercles, ab- fceffes, or congeftions of blood; from worms, from ftones in the heart, from poifons. But why diftrefs us with the catalogue of thefe and many other horrible things, till firft he have explained palpitation to us as a common but merely nervous difeafe, which many feel but few complain of?

Were a man to ftudy only thefe examples of organic difeafe, he muft of courfe believe that there were no other, and think that every palpitation portended death; while palpitation is, in truth, the nervous difeafe of boys and girls, of women, or of weakly men: it alarms the young and the robuft; while, in fact, organic difeafe belongs rather to advanced life, and comes ferioufly upon us at a time when all fears about palpitations are paft and over.

I like what Galen fays (Lib. de Loc. Affect. cap. ii.) " Palpitatio vifceris hujus, pluribus integra valetudine

degentibus,

degentibus, cum adolefcentibus tum adultis, fubito, fine ullo alio manifefto accidente, evenire vifa eft." I think it dangerous to add what follows ; " atque omnes eos fanguinis detractio juvit ;" for I know fuch bleeding to be but a temporary relief, more than counterbalanced by a permanent lofs. This text I fhall explain a very little, and then conclude : for palpitation is, indeed, the dif- eafe of boys and of young men, as I have juft explained, but not of the aged, in whom chiefly we find organic difeafe.

Palpitation is like that fluttering which fear brings on; the heart rifes in its action till it throbs, and beats againft the ribs ; it is ftrongly felt, it is even audible to the by- ftanders, and ftill it is but a nervous difeafe. Its inter- miffions ufually diftinguifh it from any organic difeafe ; its paroxyfms laft for many days or weeks ; and for weeks or months again it goes quite away. We fee it relieved by a jaunt, by living from home and in company, by leaving all bufinefs and thoughts of bufinefs quite be- hind : we fee the caufes which bring it on as plainly as we know the caufe of marfh fever, or the plague. The confinement even of a boil will caufe it ; the confine- ment of fevere ftudy is fure to caufe it ; and fevere ftudy, with an anxious mind, in a young man unufed to ftudy ; neglected where he is, and at a diftance from all his friends, are fure to produce this diftrefs. " My fon," fays Wierius, " while at Bologna purfuing his ftudies, had this afflicting palpitation, accompanied with a ca- pricious, frequent, and intermitting pulfe ; but by bleed- ing (which the older phyficians never neglected), and care, and relaxation from his ftudies, he got quite well." This is the palpitation which the older authors diftin- guifhed by the name of palpitatio cardiaca, marking it as proceeding from the ftomach ; equivalent, in the lan- guage of the prefent time, to the calling it a nervous difeafe.

Thefe, then, are the habits in which it occurs, and this its caufe : and there remains but two things to be fhortly obferved, or rather to be proved, viz. that it is fometimes as alarming as an organic difeafe is ; and that
bleeding

bleeding is dangerous in an extreme degree, or at leaſt that it does not, as Galen affirms, "always bring relief."

"Sanctius Velaſco, ſon of the Count Velaſco, had a palpitation of the heart ſo terrible, that I and many by-ſtanders often heard it diſtinctly, as if a ſtone had been plumped into a jug half full of water.*" Yet this boy got entirely well, and his phyſicians made them-ſelves very happy in the thought that they had cured him, by a ſacculus of aromatic herbs ſteeped in wine applied to the region of his heart; and by the ſame aro-matics, or cardiacs as they called them, given along with his food.

I prove the ſecond point, viz. the danger of bleeding, by a moſt alarming caſe, delivered by Morgagni, which I fear might (if it had ſo pleaſed the writers) have had in the records of medicine many precedents; it wholly deſtroys the authority of Galen's rule, and plainly in-ſtructs us never to bleed. "A boarding-miſtreſs, hav-ing a ſlighter palpitation of the heart, was bled with ſome appearance of relief: but after two days her palpi-tations returned with ſuch violence, that the breaſt ſeemed at every ſtroke to be lifted up; ſhe had withal pain, fever, and difficult breathing. They continued bleeding her firſt in the arm, which did no good; then in the foot, which was abſolutely fatal; for in an hour after ſhe died, the pulſe becoming quicker inſtantly, and falling gradually lower and lower, and giving leſs reſiſ-tance to the finger till ſhe expired." In her viſcera both of the belly and of the thorax, every thing was entire, ſound, and natural; and it had been well for the phyſicians who attended her, had they remembered that the very name of palpitatio cardiaca implies a courſe of proceeding quite the reverſe of this.

Thus the ſimple diſeaſe of nervous palpitation is often ill underſtood, and the patient's health abuſed, and his miſeries and agony of mind, and his real diſeaſe, all in-

* Chriſtoph. a Vegas *Ars Medendi*, lib. iii. ſect. 6. cap. 8.

G 3   creaſed.

creafed, by the ferious looks of his phyficians, when, perhaps, it is but a very fimple cafe.

The French phyficians, in a very formal confultation, made a very public miftake of this kind, in the difeafe of Marinus de Caballis, ambaffador at Paris from the Venetian ftate. He complained to them of his palpitation and of his intermitting pulfe, and they conceaiing nothing of their opinion from him, prognofticated the very worft; advifed him to demand his audience of leave, to go off for his native country, and there to make his will, fettle all the affairs of his family, and then compofe himfelf for his laft hour. Having obeyed them in all things, he arrived in Italy very difconfolate and dejected, and their prognoftic was well nigh fulfilled. But, like a man who would have another throw for one precious ftake, he called a confultation of the college; among whom, happily, was Victor Trincavelli, then profeffor in the univerfity of Pavia; who, perceiving that fuch tremors of his pulfe proceeded entirely from the great charge of important matters which lay heavy upon his mind, affured him of recovering his health. He ordered frequent bleedings, which the peculiar fulnefs of his habit feemed to require; and by cordial medicines he was entirely reftored, and lived long;—a man of great fcience, and fkilful in many languages. After this fad journey, he performed with much honour to the ftate two fplendid embaffies to the Emperor and to the Turks.

Let no one in future pronounce fo rafhly; it is time alone, and various modes of living, that can explain to us whether there be in any individual cafe a fixed difeafe. Nor would I dare to fpeak of the organic difeafes of the heart, without explaining more fully an idea which Albertine has fhortly and fimply expreffed. " Formerly, in difeafed refpiration, any vitiated ftructure of the heart and præcordia were unheard of; but after obfervations being feveral times repeated in dead bodies, the fame names are too much heard of and too much dreaded in the living.

                                        BOOK

BOOK II.

OF THE ARTERIES.

AORTA.

THE arteries of all the body, (excepting only those of the lungs employed merely in oxydating the blood) arise from one trunk, the aorta; which we must describe as of great size, since we compare it with other arteries, but which is wonderfully small, considering that it is of its branches only that the whole body is composed.

Those will have the truest notion of the distorted form of the aorta who have studied the anatomy of the heart. Its root is deep buried in the flesh of the heart. In the Tortoise we see the flesh of the heart rising round the root of the aorta, and endowing it with the power of a second ventricle: in the Frog we find its internal surface beset with a triple row of valves, and its coats are like those of a ventricle, they are so exceedingly strong: in Man we find it plainly muscular, surrounded in circles with great fibres, and having much muscular power.

The beginning of the aorta, then, lies deep in the flesh of the heart; it is there that it gives off its coronary arteries; it bulges at its root into three great knobs, which mark the place of its three valves, and are called the lesser sinuses of the aorta; it is large at the root, it grows smaller as it rises, it mounts upwards and back-

G 4

wards

wards from the heart, till it begins to form its arch or curvature; its direction is first towards the right side of the thorax; looking backwards, it turns in a very distorted manner, where it forms the arch; it strides over the root of the lungs, going now to the left side and backwarks, till it touches the spine; its arch lies fo upon the forking of the trachea, that its aneurifms often burft into the lungs : it then applies itfelf clofe to the spine, fo that in aneurifms the preffure of the aorta often deftroys the vertebræ; and now lying along the left side of the fpine, and with the œfophagus running clofe by it, it paffes down through the thorax, and from that to the belly under the legs of the diaphragm.

This, then, may ferve as a fhort defcription of the aorta, which is the root of all thofe arteries which we proceed now to explain. Its ftructure is ftrong, mufcular, and continually active, performing the office of a fecond heart. When in old age it begins to lofe this mufcular power, to have its fibres embarraffed with chalky, or as they are called bony concretions, it is no longer able to refift the force of the blood; it is not dilated into aneurifms, becaufe of the acute angle which it makes, and the direct impetus of the blood, for many other arteries turn backwards with very acute angles; the arteries tied in aneurifms, amputations, and on other occafions, do not dilate; the inofculations which fave a limb after the operations for aneurifm, receive the blood in a retrograde courfe, and the angles are often very acute, yet they do not dilate too much. The arteries under joints are oftener bent than ftraight; the aorta of deformed people follows clofely the deformity of the fpine, and makes fuch fingular angles, that after once feeing them no one will talk of angles occafioning dilatation. The aorta, when dilated, in nine of ten cafes is covered with white fpots; it is difeafed; they are aged people, and almoft always the dilatation begins from the heart.

THI

THE aorta, then, is the trunk from which the general tree of the arteries is to be explained.

From the arch of the aorta go off three great arteries, which rife to the head, or bend fidewife towards the arms, and fo nourifh all the upper parts of the body. Of thefe three arteries, the firft is a great one, which contains, if I may fo exprefs it, the RIGHT CAROTID and the RIGHT SUBCLAVIAN, and divides fo as to form thofe two arteries, about one inch after it arifes from the arch ; the next is the LEFT CAROTID ARTERY going to the head ; the third is the LEFT SUBCLAVIAN, going to the left arm. Thefe three branches occupy all the arch of the aorta.

RIGHT SUBCLAVIAN.

THE right fubclavian goes off from the aorta in a more direct courfe than the left ; it is thought to receive the blood more fully ; perhaps, alfo, it is rather larger than the left fubclavian : but, at all events, there is fomething peculiar in the mechanifm of the right arm ; moft probably it is the peculiar form or direction of this artery that gives to the right arm a fuperior dexterity and ftrength. When Horfes are to be broken, we find the chief difficulty to confift in teaching them to move equally with both feet, for they prefer the right ; when a Dog trots, or when he digs the ground, he goes with his right fide foremoft, and digs chiefly with his right foot ; and in thefe creatures we find the fame arrangement of thefe arteries as in ourfelves. But in Birds, where an equal balance of ftrength is required for the wings, both fubclavian arteries are diftinct branches of the aorta. When we lofe our arm, the left hand acquires by ufe all the ftrength and dexterity of the right. Since, then, either arm can acquire this dexterity, and fince the right leg is ftronger by its dependence upon the motions of the right hand, we have every reafon to believe, that the preference given to the right hand has fome phyfical caufe, and that it is the peculiar form of this artery, viz. going off more directly on the right fide,

and

and that thofe who are ambidexter muft have the right as well as the left fubclavian going off as one independent branch.

'There is another peculiarity which has occurred. The arch fometimes gives out four branches, and the left fub-clavian, arifing firft from the arch, has paffed behind the trachea, betwixt the trachea and the œfophagus. The fubject dying of difficult deglutition, which has fubfifted from childhood, it has been attributed to the preffure of this preternatural artery, an effect which I cannot eafily believe ; and it has been propofed to rank it as a new and certainly incurable fpecies of the difeafe, under the title of dyfphagia luforia, as arifing from a lufus naturæ of this artery.

CAROTIDS.

THE next branch of the arch is the LEFT CAROTID. The two carotids mount along the fides of the neck, are felt beating ftrongly, and feem much expofed. They retire for protection behind the prominency of the thy-roid cartilage. They divide into external and internal carotids under the angle of the jaw. The EXTERNAL CAROTID fupplies the neck, the face, the infide of the throat ; and the reader will have chiefly to obferve its courfe all along the neck, its branching at the angle of the jaw, and the operations and wounds about the throat, neck, face, and efpecially about the root of the ear.

LEFT SUBCLAVIAN.

THE left fubclavian is the third branch of the aorta. Each fubclavian artery varies its name according to the parts through which it goes. This great artery of the arm is named SUBCLAVIAN under the clavicle, where it gives branches to the neck ; AXILLARY in the arm-pit, where it gives branches on the one hand to the fcapula, on the other to the breaft. It is named BRACHIAL where it runs down the arm, and where there are few im-portant branches ; and, finally, its branches, into which it divides at the bend of the arm, are named RADIAL, ULNAR,

ULNAR, and INTEROSSEOUS, becaufe they refpectively run along thefe parts, the radius, the ulna, and the interofleous membrane.

THORACIC AND ABDOMINAL AORTA.

THE aorta, after completing its arch, paffes through the thorax, giving but few branches, and thofe very flender. But the ABDOMINAL AORTA, as foon as it has emerged from under the legs of the diaphragm, gives three great abdominal arteries: Firft, the CÆLIAC, going in three branches to the liver, the ftomach, and the fpleen ; fecondly, the SUPERIOR MESENTERIC, which furnifhes all the fmall inteftines ; and thirdly, the lower MESENTERIC, which fupplies moft of the great inteftines down to the rectum. The arteries of the kidneys and of the tefticles follow thefe, and then the aorta divides into two great branches for the pelvis and legs.

The ILIAC ARTERIES are the two great branches into which the aorta divides within the abdomen, and thefe again are each fubdivided into two great arteries ; the INTERNAL ILIACS to fupply the pelvis, the EXTERNAL ILIACS to go to the thigh.

INTERNAL ILIACS.

THE INTERNAL ILIAC fupplies the bladder, the rectum, the womb, with leffer arteries ; but its great arteries go out by the openings of the pelvis to fupply the very large mufcles of the hip and thigh. Thus the the GLUTÆAL, a very great artery, turns round the bone, goes out by the fciatic notch, and goes to the glutæal mufcles. The SCIATIC, almoft equally large, turns down along the hip oppofite to the glutæal, which turns up. The pudic, of great fize, alfo turns out of the pelvis, turns inwards again towards the root of the penis, and belongs entirely to the private parts, as its name implies.

EXTERNAL ILIACS.

THE EXTERNAL ILIAC, when it paffes out of the abdomen, takes the name of FEMORAL ARTERY: it divides
into

into two vaſt arteries a little below the ligament of the
thigh : the one goes deep, belongs to the muſcles, is
called the PROFUNDA; it furniſhes all the thigh, and it
it might with the ſtricteſt propriety be named the femo-
ral artery. The FEMORAL ARTERY, as we call it, is the
other great branch, which continues ſuperficial, runs
obliquely down the fore part of the thigh, gives few and
but trivial branches to the thigh, and is really deſtined
for the leg. When the artery turns inwards towards the
ham, it is named POPLITEAL ARTERY; and, like the
artery at the bend of the arm, this one at the bending
of the knee divides into three great branches, which,
like thoſe of the arm, take their names from the bones
along which they run; the ANTERIOR TIBIAL ARTERY
lies on the fore part of the tibia ; the POSTERIOR TIBIAL
ARTERY runs along the back part of the tibia ; the FIBU-
LAR ARTERY runs along the fibula ; and theſe great arte-
ries terminate by making arches with each other in the
ſole of the foot, in the ſame manner that the RADIAL and
ULNAR ARTERIES join in great arches in the palm of
the hand.

This ſlight plan I have choſen to throw out before my
reader, that the ſucceeding parts may ſeem more metho-
dical, and that he may have at a ſlight glance the chief
parts of his taſk before him ; and knowing all his duty,
he cannot be inattentive to that on which the lives of his
fellow-creatures muſt ſo often depend.

CHAP.

CHAP. I.

OF THE ARTERIES OF THE HEAD.

SECT. I.

OF THE CAROTID ARTERIES IN GENERAL.

THE carotid arteries are alfo named the Arteriæ Cere-
bri, as if they were the fole arteries of the brain;
and the ancients, either ignorant or forgetful of there
being any other arteries for the brain, or not obferving
that the vertebral arteries might convey blood enough
for the functions of the brain, did actually name the
carotids the Arteriæ Soporiferæ; believing that, if they
were tied, the perfon muft fall afleep *. How a perfon
might die from having the great arteries of the head tied,
I can moft readily conceive; but how he fhould rather
fall afleep, and not die, is quite beyond my comprehen-
fion: and yet many of the beft anatomifts, in the beft
age of anatomy, have abufed their time repeating thefe
experiments. Vafalva, Van Swieten, Pechlinus, Lower,
and efpecially Drelincurtius in his Experimenta Canici-
dia, and many others, fpent days and weeks in tying up
the carotids of Dogs. What does all this imply? Surely
a ftrong belief in tales which would difgrace the Arabian
Nights; tales concerning a manner of tying a cord round
the neck of a She-goat, or even of a young Man, fo
that, without hurting them, they fhould be made to
fleep or wake, according to the bidding of the fpecta-
tors.

Coftæus firft tells this tale: " Circumforaneous moun-
tebanks (fays he †) often perform this miracle. They tie
a ligature round the jugular veins of a She-goat; and
they tighten it and relax it from time to time, fo that at

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* The name which we ufe, viz. that of carotids, is fynonymous
in Greek with Arteriæ Soporales.
† Difquifitiones Pathologicæ, lib. 6. cap 6.

their

their pleasure the animal falls down motionless and stupid, and at their bidding leaps up again with great vigour.' The most incredible tales soon followed, and soon crept into otherwise good and useful books. Even Hoffman seems not unwilling to believe that the Assyrians had been in use of tying up the jugular veins in their young men before circumcision, that they might feel less pain. A serious operation, God-wot! for so slight a cause. Even Morgagni talks more seriously of the She-goat, and of this snibbing of the young men of Assyria, than one could wish in respect to the character of one so truly great as Morgagni *. But the person the most celebrated in this affair was Realdus Columbus; and the wildest and most barefaced tale that ever was told, is that delivered by his pupil Valverdus in his Anatomy of the Human Body.

" The carotid arteries (says Valverdus) being tied up, or any how obstructed, the person grows stupid, and falls presently into a profound sleep. This experiment I saw at Pisa in the year 1554. It was performed upon a young man by the celebrated Columbus in the presence of a great many gentlemen and strangers, with no less misery to them than amusement to us (the pupils), who, though we knew the cause, ascribed it altogether to the black art." But if any one word of this were true, Valverdus would have told us, and been proud to tell us, by what particular operation, ligature, or pressure, this strange thing was performed; and Columbus himself, the author of this new amusement, would surely have dropped some hints about it in some place or other of his

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* The celebrated Cant not only believes this most powfully, but reasons upon it in the following manner: " Ruffus Ephesius, lib 1. cap. 34. hanc soporem adferre negat, hinc aliud nomen permitteret; sed Realdus Columbus publice in theatro demonstravit hunc effectum præstari hac arteria: itaque nomen retinebimus, UTPOTE rei CON-GRUENS. Sic enim quotidie experimur post prandium somnolentiam, quam facile deducere possumus ab effectu hujus arteriæ; nam ventriculo extenso premitur aorta descendens, quo sanguis copia majori ruit in carotides; quæ hinc extensæ comprimunt cerebrum quodammodo, quo motus animales non ita expedite absolvuntur, verum vitales augentur motus, quæ ambo fiunt in somno." *Tab. Cant impetus faciens*, p. 6.

works.

works. But from the modeſt ſilence of the maſter and the ſecrecy of the pupil, we have reaſon to believe it is untrue; and if Columbus did ever venture to exhibit ſuch a mean piece of legerdemain, he put himſelf quite upon the level with the quack and his She-goat. The quack, indeed, was much beyond him in point of merit, ſince it muſt have been far eaſier to teach a clever young Man to fall down or ſtart up than to teach all this to a She-goat.

Galen has explained it well, ſaying, " that phyſicians and philoſophers, tying the carotid arteries, tie in along with them the recurrent nerves which ſerve for the voice; and if they will have ſilence to be ſleep, no doubt the creature is mute after their awkward operation; but no other function is hurt neither then nor afterwards."

This is the truth, and the whole truth nearly; for if but one Dog lives after both carotids are tied, nothing can be more certain than that thoſe which die muſt have ſuffered by ſome awkwardneſs or diſeaſe. Is it wonderful that, after ſuch a cruel tedious operation as this is, the Dog ſhould be exhauſted, ſhould be weakened by loſs of blood, ſhould feel ſore, and hang his head and droop, and let the ſlaver fall from his jaws? that he ſhould ſkulk in corners, look ſidelong, be jealous, and not eaſily moved from his hole? Theſe are what they have thought fit to call drowſineſs and ſigns of ſleep; but it is ſuch drowſineſs and ſuch ſleep as would have followed ſuch a cutting-up of the creature's neck, whether the experiment-maker had touched the carotids or not. The creature lolls its tongue, hangs its head, cloſes its watery and heavy eyes, is drowſy, or, in other words, feveriſh for many days: It eats with all the voracity of a Dog, but with difficulty, and ſlowly, owing to the ſwelling of its throat; and if it dies, it dies from the ſame cauſe. Nothing is more certain than that theſe are the only particular effects, and that the carotids of a Dog may be tied without any other danger than that of the wound.

There is nothing new under the ſun. We are continually tantaliſed with old tales in new forms. Who would

would expect to find at this very day a practical appli-
cation of the She-goat and the Affyrian young Men?
One author has publifhed to the world, " that a young
Lady, of a nervous and delicate conftitution, fubject to
nervous diftreffes in a wonderful variety of forms, but
more efpecially in the head, fometimes afflicted with
headachs, fometimes with delirium, fometimes with con-
vulfions, was relieved by compreffing the carotid arte-
ries."   Often by compreffing the carotid arteries, this
gentleman prevented the delirium ; " for all thefe com-
plaints proceeded from a violent palpitation of the heart
with the ftream of blood rufhing violently towards the
head."   He has feen this compreffion bring on a ftupor ;
he has feen it bring on a profound fleep.   Is it not a
pity that he had not attended more to the hiftory of
this bufinefs, and joined to thefe facts the ftory of the
She-goat and the young Men of Affyria ?

If what Dr. Parry fays be true, that in lean people, in
women at leaft, we can, by reclining the head back-
wards, comprefs the carotids entirely againft the fore-part
of the neck with the finger and thumb ; why, then, we
need have no fear of hemorrhagies of the nofe, wounds
about the jaw, cutting the parotid gland, or operations
about the tonfils or tongue ! But there is a dangerous
miftake here ; for there is (as I know by much experi-
ence) a wide difference betwixt preventing the pulfe of
an artery and fuppreffing the flow of blood through it.
In the cafe of a Man fainting during any great operation,
if you are holding in the blood with the point of your
finger upon fome great artery, you feel the pulfe there,
while the face is deadly pale, the extremities cold, and
the pulfe of the wrift and of all but the largeft arteries
gone.   In fainting, even the heart itfelf is not felt to
move ; and yet it moves, and the blood circulates : how
elfe could a perfon lie in a hyfterical faint for hours, I
had almoft faid days? I have tried, in great operations
near the trunk of the body, to ftop the blood with my
hands ; but though I could fupprefs the pulfe of the
femoral artery with my fore finger, I could not com-
mand its blood with the whole ftrength of my body, but

have

have feen it with horror rufh as freely as if my hand had not been there. In fhort, I fufpect Dr. Parry's belief of his ftopping the carotids with his finger and thumb is as vain as Dr. Monro's expectation of compreffing the abdominal aorta by pufhing with his fift againft the belly.

The carotid artery, having emerged from the cheft, runs up along the neck by the fide of the trachea, a fingle undivided artery, without twig or branch, till it touches the jaw. The length of this artery gives us a fair opportunity of obferving, of proving, if we choofe, that arteries are cylinders, and not, as they once were fuppofed, of a conical form. But the cylindrical form of this artery fhould not occupy our attention fo much, as that peculiarity of direction, which, though apparently expofed, keeps it fafe; or thofe important connections which make it fo dangerous either to cut or to tie this artery.

Firft, The carotid artery, from the place where it emerges from the cheft up to the angle of the jaw, is continually receding from the fore-part of the throat, is getting deeper and deeper by the fide of the trachea, at laft the ftrong projection of the larynx or cartilaginous part of the tube defends it; and when it has got to the angle of the jaw, it lies there fo deep under the ear, betwixt the ear and the jaw, in a fort of axilla, as we may call it, filled with fat and glands, that it is almoft out of reach of danger, unlefs it be fometimes of the furgeon's knife, but rarely of wounds.

This continual retreating of the carotid artery, deeper and deeper as it rifes along the neck, faves it from the attempts of fuicides: it is rarely cut, or when cut, it bleeds fo that no ignorant perfon can command it, and the furgeon is too late. But although tumours and aneurifms are rare, and through unwillingnefs and a well-grounded fear fuch patients are ufually left to take their fate; yet there may happen cafes in which it may be neceffary to do fo bold a thing as to tie this artery.

VOL. II.   H   Secondly,

Secondly, The connections of the carotid, as it rises along the neck, muſt determine our judgment, if ever any ſuch caſe ſhould occur. To ſtop the growth of an aneuriſm, to allow the extirpation of other tumours bout the jaw, to ſave a patient from dreadful bleedings of the throat, or from the hemorrhagies of deep wounds, when, for example, a patient is ſtabbed in the neck, or a ball paſſes through the mouth and under the angle of the jaw; theſe may, in ſome unlucky moment, preſent themſelves as motives for tying the trunk of this artery, when all its great branches are torn. But always the obſervation of Galen is to be remembered, that the nerves accompanying theſe arteries are liable to be tied together with them.

Let us recollect how the carotid artery, jugular vein, and eighth pair of nerves, come out from the ſkull, for it is almoſt at one ſingle point. The carotid artery enters by a hole in the petrous bone; the jugular vein comes out by a larger hole in the ſame bone, the foramen lacerum; immediately behind it the eighth pair of nerves, or the par vagum, goes out through a diviſion of the ſame foramen lacerum, ſeparated from the vein only by a little croſs ſlip of the dura mater; and ſo the carotid artery, jugular vein, and eighth pair, touch each other at the baſis of the ſkull. Through the whole length of the neck they continue the connection which is thus early begun. They are, indeed, incloſed in one ſheath of cellular membrane; ſo that what touches the one almoſt inevitably affects the other. The par vagum being the great nerve of the viſcera, at leaſt of the ſtomach, ſtrictures upon it or wounds are certainly fatal. A ſurgeon might eaſily, if it were poſſible for him to be called in time, take up the gaping mouth of the artery ſafely when it were cut acroſs; yet in moſt of ſuch caſes the nerve being alſo cut, the operation would be fruitleſs. But as for a deliberate diſſection of the ſkin, the artery beating furiouſly, and the parts embaraſſed with any tumour, and the operator alarmed with a deluge of blood from the veins; that, I think, would be a bold ſtep. In
ſhort,

fhort, the neceffity of any fuch operation is reduced to the accident of tumours or wounds about the angle of the jaw; in which cafes, the fponge thruft down into the wound will almoft always check the blood.

When the common carotid has rifen to the angle of the jaw, it divides into two great arteries, one going to the outfide of the head, the other to the brain; the one of courfe named the EXTERNAL, the other the INTERNAL CAROTID. Some of the moft eminent anatomifts are incorrect when they fay, that the carotid artery gives no branches till it arrives at the larynx. They fay fo becaufe the firft branch goes to the larynx; but, in fact, the carotid paffes much beyond the place to which it is to give its firft branch, for inftead of branching at the larynx, it does not do fo till it arrives at the corner of the jaw; there, as I have obferved, it can, as in an axilla, lie deep and fafe; and the laryngeal artery, which is the firft branch of the carotid, turns downwards again to touch the larynx.

The firft divifion, then, of the carotid artery is into the external and internal carotids; and the external carotid gives branches fo interefting to the furgeon, yet fo numerous, that it is at once very defirable and very difficult to get a knowledge of each: arrangement is here of more importance than in any order of arteries, though extremely ufeful in all.

ARRANGEMENT OF THE BRANCHES OF THE EXTERNAL CAROTID ARTERY.

THE external carotid gives three fets of arteries; each of which, having a plain and diftinct character, cannot be forgotten, nor their direction, nor their ufes, nor their relative importance, mifconceived; for if we confider but the parts along which the carotid artery paffes, as 1. The thyroid gland; 2. The tongue; 3. The face; 4. The phraynx; 5. The occiput; 6. The ear; 7. The

infide

infide of the jaws ; 8. The temple :—if we remember thus the order of thefe parts, we fhall not forget the order in which the branches go off.

But it will be further very ufeful to obferve, that thefe many branches divide themfelves moft naturally into three fets.

1. The branches which go off from the carotid forwards are peculiary important ; one of them goes to the thyroid gland, another to the tongue, and a third to the face ; parts which, to fay no more, are peculiarly expofed ; but they are, befides, the fubject of many particular operations.

2. Thofe branches which go backwards and inwards, as the pharyngeal, the auricular, and the occipital arteries going to the ear the pharynx and the occiput are both extremely fmall, and alfo run fo deep, that wounds of them are rare and of lefs importance, and fortunately thofe branches are the only ones which it is difficult to remember.

3. The great artery which paffes behind the lower jaw, named maxillary artery, and the temporal artery which lies behind the jaw, imbedded in the parotid gland, muft be ftudied with particular care ; the difficulty of cutting tumours here, the courfe of the temporal artery in which we bleed, and which, lying imbedded in the parotid gland, demonftrates the abfurdity of talking about cutting out the parotid gland, fince plainly it cannot be done ; and, laftly, the terrible hemorrhagies which often happen from the throat, nofe, tonfils, &c. gives an importance to thefe two branches above almoft any other. They fhould be very familiarly known to the furgeon.

Thefe, then, are the three divifions of the external carotid artery which are to be defcribed.

FIRST

FIRST ORDER,

INCLUDING the arteries which go forward to the thy-roid gland, tongue, and face.

I. ARTERIA THYROIDEA.

THE THYROID ARTERY, often alfo named the upper laryngeal artery, comes off from the external carotid almoft in the very moment in which it feparates from the internal carotid. Its place is behind the angle of the jaw; it goes downwards and forwards in a very tortuous form, till it arrives at the thyroid gland, upon which it is almoft entirely expended; but yet it gives fome bran-ches, or rather twigs, of which the following are the chief:

1. One fuperficial branch goes upwards to the os hyoides, and fends its twigs fometimes under, fome-times over, the os hyoides: it belongs chiefly to that muf-cle and to that piece of membrane which join the os hy-oides with the thyroid cartilage, named mufculus hyo-thyroideus. This branch is both long and beautiful; it meets its fellow of the oppofite fide with free inofcula-tions; it fupplies cutaneous twigs, and twigs to the platifma myoides.

2. A fecond fuperficial twig goes downwards to the lower part of the thyroid cartilage, where it meets the cricoid, and there gives little arteries to the maftoid mufcle, jugular vein, and fkin.

3. There is another branch which proceeds frequently enough from this fecond one: it belongs entirely to the larynx, for which reafon the thyroid is often named the fuperior laryngeal artery: it dives immediately betwixt the cartilages of the larynx; it enters betwixt the thyroid and cricoid cartilages, carries in along with it a twig from the eighth pair of nerves; it gives its twigs to the epiglottis, and to all the fmall mufcles which lie under cover of the thyroid cartilage, and which move the little arytenoid cartilages; and then paffes outward emerging

H 3   from

from the larynx, and appears again fupplying the cri-
cothyroideus mufcle.

4. The fourth branch of the thyroid is properly the
main artery, or continuation of this branch into the fub-
ftance of the thyroid gland ; it applies itfelf to the fide
of the gland, nourifhes its fubftance by a great many
fmall branches into which it is divided. Thefe branches
are all oblique, tending downwards and forwards. Their
courfe is upon the fide of the gland, becaufe, indeed,
the gland confifts chiefly of two lateral lobes, and hard-
ly any of the gland, or only a fmall portion croffes the
trachea ; confequently this artery does not inofculate fo
much with its fellow of the oppofite fide as with the
lower thyroid, which comes from the fubclavian artery,
and whofe branches, mounting upon the lower part of
the gland, have pretty nearly the fame degree of obli-
quity with thofe of the upper thyroid.

2. ARTERIA LINGUALIS.

The lingual artery is one of which the four
branches are nearly of an equal fize, and which of
courfe require all of them to be equally well remem-
bered. It is next to the thyroid, comes off immediately
above it, goes forwards towards the os hyoides, and at
the fame time upwards towards the tongue ; but all
along it lies flat upon the fide of the tongue upon its
flefh or mufcles, and gives the following branches.

1. Upon paffing the horn of the os hyoides, it gives
firft one twig of lefs note backwards to the conftrictor
pharyngis, at the place where that conftrictor arifes from
the horn of the os hyoides (viz. the conftrictor medius);
and it gives another branch forwards round the bafis of
the os hyoides, where it meets its fellow : and to thofe
who are acquainted with the mufcles which arife from
the os hyoides, it is needlefs to fay what mufcles it fup-
plies *. This, which is named the RAMUS HYOIDEUS,
feems to be very neceffary, becaufe it is a very conftant

* Viz. the hyo-gloffus, digaftricus, mylo-hyoideus, the coraco-
hyoideus, fterno-hyoideus, and hyo-thyroideus.

branch ;

branch; and when it does not come from the lingual, it infallibly arifes from fome other, commonly from the labial artery.

2. DORSALIS LINGUÆ is a branch which goes off from the lingual at the infertion of the ftylo-gloffus mufcle into the tongue: it turns firft outwards a little, and then inwards over the root of the tongue, where the arteries of the oppofite fides meet, and form a fort of network. Its chief branches are directed backwards towards the epiglottis and mouth of the pharynx, amygdalæ, &c.

About the middle of the tongue, or about half way to the chin, meafuring along the jaw, the lingual artery forks into two branches; the one below the tongue, the fublingualis, belongs to the fublingual gland and furrounding parts; the other remaining at the root of the tongue, belongs to the tongue itfelf.

3. SUBLINGUALIS then arifes next; it comes from the fide of the artery next the tongue; it runs under the fublingual gland, covered like it by the genio-hyoideus mufcle, and emerges only when it arrives at the chin, where it terminates in the fkin. Its branches are chiefly to the fublingual gland, which lies over it, and to the genio-hyoidei and mylo-hyoidei mufcles and fkin, for thefe are the parts which immediately cover it.

4. The ARTERIA RANINA is the larger branch of thefe two; it runs along the root of the tongue quite to the tip of it. In this courfe it is accompanied by its vein, which appears on the infide of the mouth when we turn up the tip of the tongue. This is the vein which the older phyficians were fo fond of having opened in fore throats; the artery is that which we are fo apt to cut in dividing the frenulum linguæ; an awkwardnefs from which a great many children have died.

N. B. It runs along the genio-gloffus, which is the innermoft mufcle of the tongue.

3. ARTERIA LABIALIS.

THE labial artery is named occafionally the EXTERNAL MAXILLARY artery, to diftinguifh it from one which

goes

goes off at a higher point, and goes to the infide of the jaw ; or ANGULARIS, becaufe it goes to the corner of the mouth and there divides ; or FACIALIS, implying, that it fupplies the face, as indeed it does as far as the angle of the eye and forehead, where there are other fmall arteries. Haller adheres to this name of LABIALIS, and in compliment to him we adhere to it.

This artery is ftill carefully kept down in the deep angle ; although it is to come out upon the jaw, yet it is not expofed till it actually makes its turn : it lies under the ftylo-hyoideus and the tendon of the digaftric mufcle : it is very tortuous, that it may move along with the jaw, and lies ftill fo deep, even when it approaches the jaw-bone, that it is forced to make a very violent and fudden angle when turning over it. This fudden turn, which is fometimes almoft a circle, is made, as it were, in the heart of the great fub-maxillary gland, the artery being buried under it. The labialis is a very large artery, very tortuous ; fometimes one great trunk gives off two important arteries at once, the lingual and the facial ; in which cafe they feparate juft at the angle of the jaw, where the artery, dividing the fubftance of the gland, is quite imbedded in fat. When we confider how deep this artery lies according to this general defcription, and the parts which it paffes along, it becomes eafy to forefee what branches it will give, and to trace them in imagination.

1. Where it lies the deepeft upon the fide of the pharynx, it fends a branch directly upwards, which goes ftraight to the arch of the palate, fpreading its fmall twigs upon the arch of the palate, upon the velum palati and upon the uvula : it ufually has two fmall branches for fupplying thefe parts, one fuperficial and one deep ; and thus the labial gives a particular artery to the palate, named ARTERIA PALATINA INFERIOR.

2. It gives a particular artery to the tonfil, which arifes at that point where the ftylo-gloffius begins to mix with the other mufcles of the tongue. This little artery penetrates the walls of the pharynx upon which it lies, and fpreads its many twigs upon the tonfil and tongue.

3. While

3. While paffing through the fub-maxillary gland, dividing it, as it were, into two parts, the labial artery gives a great many fmall twigs into the fubftance of the gland itfelf; and after thefe it gives many twigs to the tongue, the fkin, the mufcles, &c. Of thefe, two chiefly are remarkable; one, which goes to the ptery-goid mufcle chiefly, though it alfo gives branches to the conftrictors of the fauces and palate, and to the root of the tongue; and another artery, more conftant and re-gular, which breaks off at the place where the labial artery curls and bends to turn upwards: it runs fuper-ficially, and goes ftraight forwards to the root of the chin, where it is named ARTERIA SUBMENTALIS: it turns upwards over the chin to the face at the middle of the chin, and often inofculates with fome of the arteries of the face: it fometimes comes from the fublingual artery.

But the artery having emerged from betwixt the lobes of the fub-maxillary gland (for this artery in a manner divides it into lobes', and from among the fat with which it is furrounded, makes a fudden turn over the angle of the jaw at that point where we feel it beating ftrongly; and then mounting upon the face, begins to give a new fet of arteries.

1. A branch to the maffeter mufcle; for the labial artery paffes over the jaw, and up the face, juft at the fore edge of the maffeter mufcle; and this branch inof-culates with a twig defcending over the furface of the maffeter from the temporal artery.

2. The labial artery afcending in the holloweft part of the cheek, and lying flat upon the buccinator mufcle, gives out fmall branches to it, which inofculate chiefly with the tranfverfalis faciei, another branch, and a con-fiderable one, coming from the temporal artery acrofs the face. Here alfo the main artery has ftill a very fer-pentine line, on account of the continual motions of the part.

3. Before the artery comes to that point where it is to give off the coronary artery of the lower lip, it gives a branch named labialis inferior; which artery belongs

to

to the lower part of the lower lip: its branches go to
the triangularis and quadratus mufcles, which lie on the
chin and on the fide of the chin, and alfo to the lower
part of the orbicularis oris.   This branch inofculates
particularly with a twig, which comes from within the
lower jaw through the mental hole, and with its fellow,
and of courfe with the coronary arteries which run im-
mediately above it, viz. in the red part of the lip.

The artery now divides into two branches, one for
each lip, named the CORONARY ARTIRIES, becaufe
they always furround the lips entirely, though their
manner of going off is not perfectly regular.   The lower
coronary artery is ufually fmaller, and is to be named
the branch, while the upper one not only furrounds the
lip, but mounts along the fide of the nofe; it is larger;
and is therefore to be confidered as the continued trunk.
We frequently obferve the upper coronary larger on one
fide of the face, and the lower coronary larger on the
other.

4. The LOWER CORONARY comes off about an inch
or more from the angle of the mouth, at that point
where the triangularis oris and many other mufcles meet.
It goes directly forwards to the angle of the mouth,
enters into the lower part of the lip, and runs along
the red pulpy part of it, where with the finger and
thumb it can be felt beating.   It inofculates with all the
arteries formerly mentioned; as the fubmental, the twig
which comes through the hole near the chin, the inferior
labial artery, and with its fellow.   With all thefe it in-
ofculates fo freely, that it fignifies little from which fide
your injection is driven: it goes freely all round the
lips, and the arteries are every-where equally filled.

5. The UPPER CORONARY ARTERY we are to con-
fider as the continued trunk.   The labial artery is ftill
rifing, and ftill tortuous, when it arrives at the angle
of the mouth; runs into the border or flefhy part of the
upper lip, and runs along it till at the middle of the
lip it meets its fellow of the oppofite fide, with a very
free inofculation: yet the two arteries do not terminate
here, but ufually two very delicate arteries afcend to-
wards

wards the point of the nofe, along that little ridge from the nofe to the lip which we call the filtrum; and almoft always a confiderable artery runs up from the fuperior labial artery by the fide of the nofe. From this is given off a branch to the nofe, viz. the NASALIS LATERALIS, and now the artery ftill afcending (under the name of ANGULARIS), gives off branches to the cheek and eye-lids, and growing gradually fmaller, it arrives at laft near the angle of the eye, and inofculates pretty freely with that artery, which is named ophthalmic, becaufe it firft nourifhes the parts of the eye with many branches, and then comes out of the orbit at the corner of the eye, where, though fmall, it may be felt beating diftinctly.

SECOND ORDER.

THE fecond fet of arteries, which go backwards from the external carotid, comprehend the pharyngeal, the occipital, the auricular.

4. PHARYNGEA INFERIOR.

THE LOWER PHARYNGEAL* is a fmall flender artery, which gives no branches deferving to be numbered; it ftands alone, and fhould be defcribed as one fimple artery, whofe fmall branches fpread all about the throat in the following manner.

This artery is fmaller than any other branch of the carotid yet enumerated. It arifes oppofite to the lingual artery; and as it arifes from the inner fide, it comes out in a manner from the fork betwixt the external and internal carotid arteries: it rifes upwards very flender and delicate: it lies deep in the neck, upon the fore-part of the flat vertebræ, or rather lies upon the flat face of the longus colli mufcle†. After rifing in one flender

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* It is named lower pharyngeal, to diftinguifh it from one which comes downwards from the internal maxillary.

† When diffected, it muft be taken out in a manner from behind the œfophagus. The carotids muft be raifed outwards before it can be feen; for it lies under them, betwixt them and the throat.

artery,

artery, fingle, without branches or connections, it begins all at once to give twigs.

First, It gives branches inwards to the throat; for one twig furrounds the lower part of the pharynx about the root of the tongue, and fometimes goes forwards along with the gloffo-pharyngeal nerve into the tongue. Another twig goes to the middle of the pharynx, and wanders towards the velum palati, giving branches to the amygdalæ. And ftill another goes higher towards the bafis of the fkull; it alfo gives twigs to the velum palati, to the back of the noftrils, to the upper part of the pharynx where the upper conftrictor lies (viz. that which comes from the bafis of the fkull), and it gives fmall arteries to nourifh the bafis of the fkull; as, to the os fphenoides, to the cuneiform procefs of the occiput, to the point of the temporal bone, and to the cartilage of the Euftachian tube.

Secondly, It fends branches outwards to the maftoid mufcle, to the jugular vein, to the ganglion of the intercoftal nerve, and to the dura mater of the eighth pair; and one particular branch, very fmall and delicate, goes along conducted by the great jugular vein, enters together with it into the fkull, and makes one of the arteries of the dura mater, but it is a very delicate twig.

In general one artery only of the dura mater is known or mentioned; but here we have feen, befides the great artery of the dura mater, leffer arteries entering to it by all the perforations at the bafis of the fkull. The pharyngeal actually terminates in the dura mater, paffing through the foramen lacerum pofterius, and fending alfo a branch in together with the jugular vein. The occipital artery alfo fends one with the jugular vein, one by the foramen maftoideum, and one by a fmall hole in the occiput. The temporal often fends one through by the hole in the back part of the parietal bone.

5. ARTERIA OCCIPITALIS.

THE OCCIPITAL ARTERY is alfo a fimple artery, diftributing its twigs about the ear, over the occiput, and
down

down the back of the neck, and having no branches of fufficient importance to be particularly marked.

It arifes next to the pharyngeal from the back part of the carotid; and lying particularly deep, it not only is covered at its root by the other branches of the carotid, but is covered in all its courfe by the thick mufcles of the neck, except juft where it is pafling round the maftoid procefs.

At firft the occipital artery lies clofe in among the bones, pafling over the tranfverfe procefs of the atlas, crofling the root of the great jugular vein, and pafling under the root of the maftoid procefs, fo as to lie at this place under the belly of the digaftric mufcle. Still as it encircles the occiput, it paffes along very deep under the bellies, firft of the trachelo-maftoideus, and then of the fplenius and complexus, and emerges only when it arrives at or near the middle ridge of the occiput; and laftly, it rifes with many beautiful branches over the back of the head, to meet the branches of the temporal artery.

In this courfe the occipital artery fends out the following branches:

1. Branches to the biventer, which lies over it, and to the ftylo-hyoideus mufcle; and there is one longer artery which attaches itfelf to the root of the maftoid mufcle, and paffes along that mufcle, to inofculate with the thyroid arteries, or with the lower cervical arteries, which mount upwards as this defcends.

2. Next it gives, like the pharyngeal, a fmall artery, which goes backwards along the jugular vein; and having entered by the foramen lacerum, attaches itfelf within the fkull to that part of the dura mater which lies under the lobes of the cerebellum.

3. The occipital artery, as it paffes under the ear, fends out to it a fmall pofterior artery, which goes to the little lobe of the ear, and creeps up along its pofterior border.

4. At this point the occipital often gives another artery, which paffes upwards behind the ear, and is named the POSTERIOR TEMPORAL ARTERY.

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5. The

5. The occipital artery, as it paſſes under the tra-chelo-maſtoideus and ſplenius, gives branches to theſe two muſcles; and it ſends out from betwixt the tra-chelo-maſtoideus and complexus a long branch, which deſcends along the neck a conſiderable way; and after having further ſupplied the ſplenius, complexus, and alſo the deeper muſcles of the neck, it terminates by inoſculating with a branch from the axillary artery, which as it croſſes the neck is named tranſverſalis colli. This deſcending branch of the occipital inoſculates alſo with the vertebral arteries through the interſtices of the vertebræ.

Having pierced the belly of the complexus, the arte-ry now riſes over the occiput in ſmall and beautiful arteries; the chief of which belong to the occipital belly of the occipito-frontalis muſcle and to the ſkin: it finally ends in inoſculations with the backmoſt branches of the temporal artery. But of theſe extreme twigs of the occipital, two are remarkable, becauſe they paſs through the ſkull to the dura mater; one through a ſmall hole in the occipital ſpine, and one through that ſmall hole which is behind the maſtoid proceſs. Some-times the hole is in the temporal bone, but more fre-quently in the ſuture which ſurrounds the back part of the temporal bone*.

6. ARTERIA POSTERIOR AURIS.

THE POSTERIOR ARTERY OF THE EAR is the ſmalleſt and leaſt conſtant of all the arteries which go off from the carotid; for it is often wanting, or often comes from ſome branch, and not from the carotid itſelf; often from the occipital, ſometimes from the pharyngeal arte-ry; it can ſcarcely be reckoned as a regular branch of the carotid. This artery alſo, like the pharyngeal and occipital, gives out no diſtinguiſhed branches which we need to mark; it chiefly belongs to the ear, it gives branches to the cartilage of the external ear, it ſends

* Viz. the additamentum ſuturæ ſquamoſæ.

a larger

a larger branch through the ftylo-maftoid hole to the internal ear, and the reft of its twigs go to the integuments, or to the bones.

The POSTERIOR AURIS arifes much higher than any of thofe arteries which have been juft defcribed; it does not come off from the external carotid till it reaches the parotid gland; or rather, it arifes where the carotid is plunged into the fubftance of that gland; it paffes directly acrofs under the ftyloid procefs, and over the belly of the digaftric mufcle, and then goes up behind the ear: in this paffage it gives branches to the parotid gland, and to the biventer mufcle, the parts on which it lies; next it gives a twig, which furnifhes the root of the cartilage of the ear, and perforates the loweft part of the cartilage, fo as to fpread itfelf upon the drum of the ear; this branch is named ARTERIA TYMPANI.

Its next branch, the ARTERIA STYLO-MASTOIDEA, is the moft remarkable, for it is of confiderable fize, enters the maftoid hole, while the portio dura, or great nerve of the face, comes out: it is a chief artery of the internal ear; for it gives branches, 1. to the tympanum, one of which beautifully furrounds the bony circle, and then fpreads upon the membrane itfelf; 2. to the mufcle of the ftapes, to the femicircular canals, to the cells of the maftoid procefs and its delicate veffels; which arteries, when well injected with fize, paint the walls of the cavity of the tympanum, and of the femicircular canals.

The main artery having given off the arteria tympani and this ftylo-maftoid artery, and having paffed the ftylo-maftoid hole, becomes properly the arteria pofterior auris, rifing behind the ear, and giving its branches to the fkin and maftoid mufcle, and to the mufcle behind the ear (pofterior auris), and to the bone and periofteum, chiefly about the maftoid procefs; then its fmall branches play round the back part of the concha or fhell of the ear; and, laftly, the artery, ftill mounting behind the ear, ends in fmall twigs, which go to the fafcia of the temporal mufcle, and which of courfe inofculate above the ear with the temporal artery.

I   THIRD

THIRD ORDER.

THE third order of arteries includes the termination
of the external carotid artery in the temporal and max-
illary arteries, which is after the following manner :

The artery having entered into the parotid gland,
lies there abſolutely imbedded in its ſubſtance ; and of
the two arteries in which it terminates, one paſſes di-
rectly through the ſubſtance of the parotid gland,
emerges before the ear, mounts upon the temple, and
is named of courſe the TEMPORAL ARTERY ; it per-
forms here in the temple the ſame office which the
occipital does behind, viz. it ſupplies the pericranium,
muſcles, and ſkin : all this is very ſimple. But the
other branch, in which (ſince it is exceedingly large)
one would ſay the carotid terminates, goes off from the
temporal with a ſudden bend, ſinks very deep under
the articulation of the lower jaw, terminates in a laſh of
branches at the back of the antrum Highmorianum,
and there gives branches to the lower jaw, the upper
jaw, the inſide of the cheeks, to the temple (deep arte-
ries which lie under the temporal muſcle), to the upper
part of the pharynx, to the noſtrils, and to various
other parts ; it is this artery too which gives off the
chief artery of the dura mater. The deſcription of ſo
great an artery, ſo widely diſtributed, becomes both dif-
ficult and important.

7. ARTERIA MAXILLARIS INTERNA.

THE INTERNAL MAXILLARY ARTERY turns off from
the temporal artery while imbedded in the ſubſtance
of the parotid gland, and about the middle of the up-
right branch or proceſs of the lower jaw-bone. It
paſſes betwixt the lower jaw-bone and the outer ptery-
goid muſcle ; it then goes forwards till it touches the
back part of the antrum maxillare, and terminates in
a laſh of veſſels betwixt the back of the antrum and
the

the pterygoid procefs; and, finally, it ends at the fpheno-maxillary fiffure, or, in other terms, at the bottom of the focket of the eye, where it gives the infra-orbitary artery, and a branch to the back of the noftrils.

In all this courfe the internal maxillary artery is extremely tortuous: Firft, It rifes with a high and round turn at that point where it goes off from the temporal artery; then it bends fuddenly downwards, where it paffes betwixt the pterygoid mufcle and the jaw-bone; then, as it approaches the back of the antrum, it rifes with a third bending, and continues rifing with very great contortions, till it ends in a lafh of fmall veffels at the back of the eye and noftrils.

Before this artery gives out its greater branches, which require to be marked with numbers, it very generally gives fome fmall twigs, namelefs, and of lefs note; as a fmall twig to the ear, and the glands around it, another which gets into the tympanum to the mufcle of the malleus, and a branch of it fometimes goes into the fkull by that hole named foramen ovale, by which the fifth pair of nerves come out, and goes to that part of the dura mater which covers the fides of the fella turcica.

1. Of the larger branches which the internal maxillary gives out, the firft is the ARTERIA MENINGEA, the great or MIDDLE ARTERY of the DURA MATER. It goes off from the maxillary juft where it leaves the temporal artery. Sometimes before entering the fkull it gives fmall branches to the pterygoid mufcle, to the mouth of the Euftachian tube, to the os fphenoides, and fometimes through that bone to the dura mater; but the main artery paffes through what is called the fpinous hole, which is in the very extreme point or fpine of the fphenoid bone: it is this artery of which the furgeon fhould be particularly aware, and which touches the parietal bone at its loweft corner in the temple, and fpreads from that point all over the dura mater like the branches of a tree. But befides thefe, its chief branches, which fpread thus upon the parietal bone, on its inner
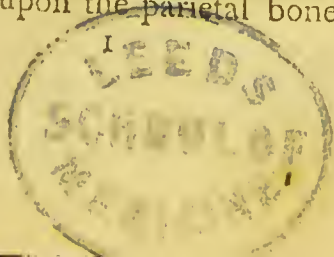
furface,

furface, it gives fmaller ones, which go into the fub-
ftance of the bone, or into the ear, and fometimes
through the orbit into the eye. Thus firft feveral
fmaller twigs go into the fubftance of the os petrofum
to nourifh it; the holes may be feen about the rough
part, where the os fquamofum and os petrofum are
united; next two twigs enter into the aqueduct by the
fmall hole on the fore-part of the petrous bone, one
keeping to the canal itfelf, the other going to the cavity
of the tympanum, and to the inner mufcle of the mal-
leus; and, laftly, one or two fmall twigs pafs through
the outer end of the foramen lacerum into the orbit,
and go to the lachrymal gland*.

2. The LOWER MAXILLAR ARTERY is a flender and
curious artery, which belongs chiefly to the teeth of the
lower jaw, and which runs all along in a canal within
the jaw-bone. The internal maxillary proceeds nearly
an inch before it gives off this branch; and then, while
lying under the pterygoid mufcle, it gives off a long
and flender artery, which enters the jaw-bone at that
great hole which is betwixt the condyloid and coronary
proceffes; then runs all along within the jaw-bone, fur-
rounding each of the teeth with arteries at the bottom
of each focket. About the middle of the jaw-bone it
divides into two branches, which proceed together in
the bony canal, till one of them emerges upon the chin
at the mental hole, inofculating there with the arteries
of the face, viz. the labial and fubmental arteries, while
the other goes onwards to fupply the roots of the fore-
teeth alfo, and to meet its fellow within the jaw-bone at
the chin. The nerve for the lower jaw enters along
with this artery; the vein of this artery accompanies it,
but lies under it in a feparate canal, though ftill in the
fame line. The artery itfelf, before it enters into the
hole of the lower jaw, commonly gives twigs to the
inner pterygoid mufcle which covers the hole. Confi-

* Sometimes the great and proper artery of the lachrymal gland,
inftead of arifing from the ophthalmic or proper artery of the eye,
arifes thus from the artery of the dura mater.

dering

dering the fize of this artery, we cannot wonder at profufe bleedings from the teeth, or rather from their fockets.

3. THE PTERYGOID ARTERIES.—While the artery is thus croffing betwixt the jaw and the pterygoid muf-cle, it gives branches to the external pterygoid mufcle, both into its fubftance and over its furfaces. The num-ber of thefe pterygoid arteries is variable and unim-portant.

Next, while the maxillary artery is paffing in a con-torted form under the zygoma, where the temporal mufcle is lodged, it gives off two arteries, which are called the DEEP TEMPORAL ARTERIES, to diftinguifh them from the proper temporal artery, the only one which we feel outwardly, and which is fuperficial. Of thefe two deep temporal arteries, one runs more out-wards, viz. towards the ear, the other runs more in-wards, viz. clofer upon the bone; whence the one is called the DEEP EXTERNAL, the other the DEEP INTER-NAL, TEMPORAL ARTERY.

4. THE DEEP EXTERNAL TEMPORAL ARTERY arifes where the maxillary is paffing under or near the jugum; it is of courfe near the coronary procefs of the jaw-bone. This branch then paffes along the tendon of the temporal mufcle, and ends in that mufcle, giving branches alfo to the external pterygoid mufcle; it is a fhort artery, and not very important by its fize.

5. The deep internal temporal artery arifes farther forwards, viz. where the artery is clofe upon the back of the antrum; from which point, mounting directly upwards, it paffes in the very deepeft part of the tem-poral arch, viz. that which is formed by the cheek-bone. It is longer and more important than the outward branch, fupplies the deepeft and thickeft part of the temporal mufcle, mounts pretty high upon the temple betwixt the mufcle and the bone, and often, where it lies behind the cheek-bone, it fends a branch through that bone into the orbit which fupplies the fat and peri-ofteum of the focket, and in fome degree alfo the lachrymal gland.

<center>I 2</center>

6. The

6. The ARTERY OF THE CHEEK is a very regular artery, in so far as regards its destination, viz. for the cheek ; but in its origin it is extremely irregular. It has not often the importance of coming off as a distinct branch from the maxillary ; but comes off rather more frequently from some of its branches, as from the deep temporal artery just described, or from the alveolar, or infra-orbital arteries, which are presently to be described. This artery perforates the buccinator muscle, and is spent upon it, and upon the other muscles of the cheek, as the zygomaticus and levator labii ; it ends, of course, by inosculations with the arteries of the face.

7. The ARTERY OF THE UPPER JAW serves much the same office with that of the lower jaw, viz. supplying chiefly the sockets of the teeth ; whence it is named ARTERIA ALVEOLARIS. It is an artery fully as large as that of the lower jaw ; it begins upon the back of the antrum Highmorianum, and runs round that tuberosity towards the face and cheek with very tortuous branches. Its branches are distributed first to the buccinator and fat, which fills up the great hollow under the cheek-bone, and also to the cheek-bone itself, where it is connected with the jaw-bone. Secondly, Other branches perforate into the antrum Highmorianum by small holes, which are easily seen upon its back part, and some of these branches go into the sockets of the backmost teeth. Thirdly, A more important branch than any of these, the branch indeed from which it has its name of alveolar artery, enters by a hole into the substance of the jaw-bone, and goes round in the canal of the teeth just as the artery of the lower jaw does, giving branches to each socket. The curlings of this artery upon the back of the antrum are very curious ; and while its deeper artery furnishes the teeth, some of the superficial branches go to the gums.

8. The INFRA-ORBITAL is so named from the hole or groove by which it passes all along under the eye from the back of the nostril till it emerges upon the face. The infra-orbital, and the branch last described, viz. the alveolar artery, generally come off from the maxillary by one common trunk ; the alveolar goes forwards and down

downwards by the back of the antrum : the infra-orbital mounts upwards, and enters the fpheno-maxillary hole, or rather it comes off juft at the fpheno-maxillary hole, which is the great flit at the bottom of the eye. As the artery enters its proper canal at the bottom of the eye, it gives fome twigs to the periofteum and to the fat of the focket ; as it paffes along its canal in the bone, one branch dives down into the antrum through the bone ; for this plate of bone in which its groove runs, is at once the floor of the eye and the roof the antrum ; within the focket it gives twigs alfo to the deprimens occuli, and to the lower oblique mufcle, to the lachrymal fac, or even to the noftrils ; when it emerges from the focket by the infra-orbitary hole, it terminates in the levator labii and levator anguli oris, and in inofculations with the arteria buccalis, labialis, and efpecially with the nafal branch of the occular artery. This infra-orbitary artery is accompanied through the canal, and out upon the face, with a fmall nerve of the fame name, viz. the infra-orbitary nerve.

After this the maxillary, though nearly exhaufted, ftill fends out three fmall arteries, in which it terminates irregularly, fometimes one, fometimes another twig being larger. Of thefe three, one goes to the palate, one to the pharynx, one to the noftrils.

9. The UPPER PALATINE ARTERY arifes near the infra-orbital ; and from that point, viz. the fpheno-maxillary flit, it defcends along the groove, which is formed betwixt the pterygoid procefs and the palate bone ; and when it has got down to the palate, one leffer branch turns backwards through the pofterior palatine hole, and expands upon the velum palati ; the other larger branch is the great palatine artery, for it comes through the anterior or larger palatine hole ; the artery itfelf is large, it runs all along the roof of the mouth betwixt the pulpy fubftance of the palate and the bone ; in this progrefs it gives little arteries to the fockets of the teeth, and it frequently terminates, not merely in the palate itfelf, but in a fmall artery which runs up through tne foramen incifivum, or hole under the fore-teeth, into the cavity of the

nofe

nofe. This artery is alfo accompanied with a correfpond-ing palatine nerve.

10. The UPPER PHARYNGEAL ARTERY is the higheft of all the branches of the internal maxillary ; it goes off at the back of the orbit, oppofite the fpheno-maxilla-ry fiffure ; it afcends along the fphenoid bone to the place of the fphenoidal finus, and along the upper part or arch of the pharynx, where that bag adheres to the bafis of the fkull ; it alfo goes along the fides of the pharynx : its twigs are of very diminutive fize ; fome go into the fubftance of the fphenoid bone to nourifh it by fmall holes both over the cells and in the alæ : a branch goes towards the ptery goidean or vidian hole*, where it inof-culates ufually with a branch from the internal carotid artery, fometimes with the lower pharyngeal, or with the meningeal arteries.

This artery ends in fmall branches which play round the mouth of the Euftachian tube.

11. The NASAL ARTERY is the laft branch of the in-ternal maxillary. It paffes through the fpheno-palatine hole † ; by this opening it comes into the noftril at its upper and back part ; the twigs go, one fhorter to the backmoft of the æthmoid cells, another to the cells of the fphenoid bone ; one longer branch goes to the back part of the feptum narium ; and one branch, the longeft of all, often paffes both the upper and lower fpongy bones (along the lining membrane of the nofe, giving twigs to the antrum as it paffes), till it inofculates with that twig of the palatine artery which rifes through the foramen incifivum into the nofe. This nafal artery often has two branches.

* This is the hole by which the recurrent of the 5th pair goes backwards from the nofe into the fkull.

† Obferve, this is not the fpheno-maxillary flit fo often mentioned ; which is a flit-like opening lying between the wing of the fphenoid bone and the upper jaw-bone ; and, as it is at the bottom of the focket, whatever parts enter it go to the eye. The fpheno-palatine hole is betwixt the fphenoid and palate bones ; it is at the back of the noftrils, and the branch which enters it belongs to the noftril.

8. ARTE-

8. ARTERIA TEMPORALIS.

The TEMPORAL ARTERY, if we confider its ftraight direction, may be regarded as the termination of the external carotid artery. When the maxillary artery bends away from it to go under the jaw, this goes directly forwards through the fubftance of the parotid gland, mounts before the ear ; and as it paffes alternately the parotid gland, the face, the ear, it gives its three chief branches to thefe parts, and ends in that temporal artery which runs along the fide of the head under the fkin, which we feel, and even fee diftinctly, beating, and which we open when bleeding in the temples is required.

The temporal artery is named SUPERFICIAL, becaufe of its lying under the fkin only, above the fafcia of the temporal mufcle, while the deep branches from the maxillary artery lie under the mufcle.——The temporal artery paffes juft before the meatus auditorius, and behind the branch of the jaw-bone ; it pufhes its way through the fubftance of the parotid gland, and there it gives its firft branches, commonly feven or eight in number, but quite irregular, into the fubftance of the gland itfelf; next it gives off to the face an artery of very confiderable fize ; which arifes from the fame part of the artery with thefe parotideal branches, viz. under the zygoma and within the gland : like them it goes off almoft at a right angle, and is like one of them, but larger, nearly of the fize of a crow-quill ; it pufhes fidewife through the fubftance of the parotid, emerges from it upon the face juft below the cheek-bone ; runs acrofs the cheek in the fame direction with the parotid duct ; it is named from this direction TRANSVERSALIS FACIEI. Its branches go to the joint of the jaw-bone, the maffeter, buccinator, parotid gland, &c. and terminate in inofculations with all the arteries of the face.

Next the temporal artery, as it rifes towards the zygoma, and of courfe approaches the angle of the jaw, gives an artery which is proper to the articulation of the jaw. This artery belonging to the joint of the jaw is often named ARTERIA ARTICULARIS. After

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having

having sent its two branches to the articulation of the jaw, it sends another artery to the ear, which divides into two twigs; one of them going round the back part of the ear, affists the branch of the ftylo-maftoid artery in forming the little circular artery of the tympanum; while another branch, penetrating through the flit which is in the articulation of the lower jaw, goes to the mufcle of the malleus.

But before it reaches the zygoma, the temporal artery gives another branch, which is named the MIDDLE TEMPORAL ARTERY, to diftinguifh it from the deep temporal arteries which lie under the whole thicknefs of the temporal mufcles, and the fuperficial temporal, which lies above the fafcia; for this middle temporal artery lies under the fafcia: but on the outfide of the mufcle it arifes from the main artery juft under the zygoma, rifes over the zygoma, and then pierces its way under the fafcia of the temporal mufcle, and under that covering gives branches to the temporal mufcle, the artery itfelf ftill rifing and pafling obliquely forwards towards the outer corner of the eye, where one of its twigs often goes to the orbicularis oculi, and inofculates with the ophthalmic artery.

About this point, or rather above the zygoma, the temporal gives off thofe fmall arteries, irregular in number, which are named ANTERIORES AURIS, the anterior arteries of the ear, and which play all round the fore-part of the ear.

The temporal artery having now emerged from the parotid gland, and from the thick fafcia which covers it, makes a fudden ferpentine turn before the ear; and then rifing about half an inch perpendicularly, it forks with a pretty wide angle into two arteries, which are named the anterior and pofterior temporal arteries. Thefe lie quite fuperficial under the fkin, above the fafcia, and are diftributed in this manner; Firft, the ANTERIOR TEMPORAL ARTERY goes directly forwards to the naked part of the temple, runs up the fide of the forehead with a very ferpentine courfe; it is here that in old men we fee its contortions and pulfation very dif-
tinctly;

tinctly; it goes round arching forwards, and upwards from the temple towards the top of the head. It belongs chiefly to the fkin and frontal mufcle, and that tendinous kind of fheath which covers the cranium; it gives fome branches to the orbicular and corrugator mufcles; it forms often a fuperciliary arch with the proper frontal artery; it often fends off a branch very early towards the outer corner of the eye, which is entirely deftined for the orbicularis oculi.

The POSTERIOR TEMPORAL ARTERY is the laft branch of all. It arches backwards over the top of the ear; it turns thus backwards till it meets the branches of the occipital artery; it deals its branches from either fide upwards and downwards, i. e. towards the ear, and towards the top of the head in great profufion, till it is quite exhaufted. Thefe branches belong to the fkin chiefly and to the pericranium; and the fmaller twigs pierce the outer tables of the fkull, and go into the bone in great profufion for its nourifhment.

CONCLUSION.

IT would furely be wrong to conclude the defcription of a fyftem of arteries fo important as this, without attempting to intereft my reader in this piece of anatomy, by obferving a few anatomical and furgical facts.

That arteries are not tortuous to favour the extenfion of parts, but rather becaufe they have been extended and long pufhed by the current of blood, is a fact very manifeft to any one who confiders the condition of many of thefe arteries which I have juft defcribed. When we firft obferve the thyroid, lingual, and labial arteries; when we confider that the tongue, the throat, the lips, are moveable and dilatable parts—we are apt to fay that fuch arteries are tortuous to favour thofe motions. But when we remark the curling form of the alveolar artery, where it lies againft the back of the antrum; of the occipital artery, where it lies firm againft the bone; of the temporal, where it rifes along the fide of the head

head—we perceive clearly that this curling has nothing
to do with dilatation.   And Dr. Hunter's obfervation of
the arteries of the womb being tortuous, to allow of
extenfion, is not like the obfervation of fo great an ana-.
tomift, but of one who had not confidered many of the
chief arteries in the body : For the womb itfelf has its
arteries more tortuous at the end of pregnancy than at
its commencement ; and the ftomach, the bowels, the
bladder, although they fuffer greater and more fudden
diftenfion than the womb, have arteries which are very
ftraight in their courfe.   Are there any curling arteries
in the mufcles which contract to one half their diame-
ter? are there any in the joints which twift and bend
fo freely? are there any curling arteries in the whole
fyftem of a child? are there any arteries in the whole
fyftem of an aged perfon which want this tortuous
form? In fhort, this tortuous form has no relation to
the dilatation of the parts : it is merely a confequence of
the long continued preffure of the blood : it is this
only that can account for the flowly increafing tortuofity
in the temples or hands of an old man, or the fudden
tortuofity which the newly dilated artery affumes after
the operation for aneurifm.

Next it is natural to obferve, as a thing which may
prevent confufion in the ftudent's mind, how irregu-
lar (after all our attempts at arrangement) the fmaller
arteries unavoidably muft be ; how natural it is that
each particular part fhould draw its blood from all the
arteries which are near or round it.   The ear has its
pofterior artery peculiar to itfelf; but it has alfo an
anterior artery from the temporal, where it lies under
the parotid gland ; and it has even a fuperior auris from
that branch of the temporal artery, which bends round
towards the occiput, and arches over the ear.   The dura
mater has its great middle artery appropriated to itfelf,
a peculiar branch, the firft of the maxillary artery ; but
it has befides fmall affifting arteries, entering by almoft
every point at the bafis of the fkull ; and efpecially it
has arteries from the maxillary, by the mouth of the
Euftachian tube, from the pharyngeal, running in by

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                                                            the

the hole for the great jugular vein ; and from the occi-
pital both by the hole of the jugular vein in the bafis of
the fkull, and alfo by the fmall occipital hole in the
back part of the fkull, clofe by the temporal bone.
The throat alfo, though it has many peculiar arteries,
derives its branches from a great many fources ; as from
the lingual artery by twigs, which crofs the root of the
tongue ; from the labial artery by branches, which go
to the tonfil, tongue, and palate ; from the pharyngeal
artery, many branches not confining themfelves to the
pharynx, ftretch forwards to the palate, tongue, and
tonfils ; and, laftly, the maxillary artery gives a pro-
fufion of branches to all parts of the throat. Thefe
may ferve as hints by which the ftudent, if he wifhes
to become a correct anatomift, may trace the inofcula-
tions ; or for the furgeon, if he wifhes to feparate the
ftudy of this minute anatomy from that of the greater
arteries.

The furgeon's intereft in underftanding thefe arteries
is, indeed, very ftrong. It were impoffible to enumerate
all the various occafions on which this piece of anatomy
may be ufeful ; but, furely, one may eafily fay enough
on this fubject to attach the young furgeon to the dili-
gent ftudy of thefe arteries.

Among the various motives for diligence, I would
mention thefe ; the terrible hæmorrhagies which he is
daily called to ftop, when fuicides, though they have
not cut the carotids, have cut the great arteries of the
thyroid gland ; the neceffity of thinking about the tu-
mours of the gland itfelf, for I have had the unhappi-
nefs to fee a perfon perifh by fuffocation while confult-
ing phyficians forbade any operation ; and I had no
other than the melancholy privilege of watching, for
many hours, the laft ftruggles of a perfon, who had the
day before been walking through all the rooms in tole-
rable eafe and health. Could nothing have been re-
folved on ? Muft we always fubmit to this ? Might not
an incifion in the fore part (where few arteries are)
have at leaft uncovered the trachea, given a temporary
relief, and made the tumor fuppurate more freely ? The
extirpation

extirpation of the tongue, which is mentioned with
horror, would be a lefs terrible operation to one ac.
quainted with thefe arteries; the extirpation of all tu-
mours under the jaws is dangerous; the cutting out
completely the parotid gland is a thing quite impoffible,
fince the. greateft of all the arteries, viz. the temporal
and the maxillary, lie abfolutely imbedded in the gland.
What fhall we think, then, of thofe furgeons who talk
in fuch familiar terms of cutting out the parotid gland?
Bleedings from the nofe have been fo often fatal, that
Petit is celebrated to this day for a difcovery which he
never made, viz. the way of plugging the nofe fo as to
ftop this bleeding. Have not the French Society been
bufy renewing inventions for fecuring even fo fmall
an artery as that of the dura mater? In the hair-lip
operation, in cutting cancers, in diffecting tumours from
all parts of the face, the furgeon commands the blood
only by knowing thefe arteries. Cowper, the celebrated
furgeon and anatomift, had his head fo full of this pro-
ject, that inftead of waiting for hæmorrhage during his
operation, he cut off two days before the chief fource
of the blood. He was going to cut out the parotid
gland; and two days before he placed a fmall button of
cauftic on each fide of the labial artery, where it lies
upon the cheek, paffed a ligature under it, tied it firm,
and then proceeded to his operation next day. But
this great anatomift made at one ftroke two grievous
blunders: he miffed, for want of knowledge, the chief
arteries of the parotid gland, for they come from the
temporal artery; and, if I miftake not, he had tied the
vein, for moft affuredly it is the fafcial vein which he is
defcribing in his twelfth table from Bidloo. How ter-
rible the extirpation of tumours from the gums, throat,
tonfils, &c. I need not fay; where the furgeon always
ufes burning irons inftead of needles, where not unfre-
quently the patient dies.

SECT.

SECT. II.

OF THE ARTERIES OF THE BRAIN, SPINAL MARROW, AND EYE.

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§ 1. OF THE ARTERIES OF THE BRAIN.

THE INTERNAL CAROTID ARTERIES are named the ARTERIÆ CEREBRI, as being the chief arteries of the brain; while, in truth, the brain is also supplied by two other arteries nearly equal in size, viz. the vertebral arteries, which, though they do indeed arise from a different trunk, viz. the subclavian artery, yet are so entirely destined for the brain, give so few branches before they reach the skull, are so important when they arrive there, and above all make so large a communication with the carotid arteries, that without a description of the vertebral arteries, any description of the carotids must be defective; they unite so with the carotids as to form but one great system of vessels for supplying the brain.

The two greatest functions of the animal body, those of the womb and of the brain, the one for the life of the individual, the other for the continuation of the species, are the most liberally supplied with blood. The womb has on each side two arteries; it has two spermatics, and two hypogastrics, and the inosculations of these vessels are very large and free. The brain has two great arteries on each side; it has two carotids, and two vertebral arteries; they are infinitely larger than those of the womb; their inosculations are so particular, that there are no others like them in all the body: the injection of any one artery easily fills the whole; the preservation of but one artery saves the life of the creature, when the others are stopped.

These four arteries alone convey to the head the fifth part of the whole mass of blood. This is the calculation of the older authors; and even those who would

settle

fettle it at the loweft point ftill acknowledge, that the
carotid and vertebral arteries receive at leaft the tenth
part of all the blood of the body. The brain then
which weighs not a fortieth part of the whole body, re-
ceives one-tenth of all the blood; a proportion which
muft occafion furprife.

Befides the profufion of blood which thus rufhes
into the brain, the impetus with which it forces its way
feems dangerous; and Nature alfo feems to have pro-
vided againft the danger. We cannot be but fenfible
of this danger; for the flighteft increafe of velocity
occafions ftrange feelings, if not abfolute pain. We
cannot run for any length of way, nor afcend a ftair
rapidly, nor fuffer a paroxyfm of fever, nor in fhort have
the circulation quickened by violent exertions, by emo-
tions of the mind, or by difeafe, without feeling an
alarming beating within the head; we feel it particularly
in the carotid canal where the artery paffes through
the bone. If it continue from difeafe, or if we perfift
in our exertions, giddinefs, blindnefs, ringing of the
ears, come on. Haller remembers, that while he was
lying in a bad fever, he fuffered fo much from the pul-
fations of the carotid artery within the fkull, that his
head was lifted from his pillow at every ftroke. I wifh
he had faid, " feemed to be lifted from his pillow at
every ftroke;" for it was rather a fickly feeling than
what could actually happen.

Did this vaft column of blood rufh directly into the
brain, we do not know what might be its effects; but
furely they could not be harmlefs, fince Nature has
provided againft it in man, and in the lower animals
which hang their heads, with a peculiar care. In Man,
this blood is retarded chiefly by the tortuous courfe
which the artery is obliged to follow, and by that long
bony canal which, by holding the carotid as in a fheath,
muft fupprefs its violent action, and at leaft prevent its
being dilated by force of the blood, when, as often
happens, the lower part of the artery is more full and
tenfe. Perhaps alfo it may have fome effect, that the
carotid, as it lies by the fide of the fella turcica, is not
naked

naked and free, but is inclofed in a venous finus, which confifts of cells like thofe of the male penis, and in the heart of which the carotid lies bathed in the blood.

It is alfo peculiar in all the arteries of the brain, that they do not enter in trunks into its fubftance. This feems to be a violence which the foft texture of the brain could not bear; but all the arteries having perforated the dura mater, attach themfelves to the pia mater, a delicate membrane, which is the immediate covering of the brain; which follows all its divifions, lobes, and convolutions; which enters all its cavities, and lines its internal furfaces as it covers the external. To this membrane of the brain the arteries attach themfelves: it conducts them every where along the furface of the brain, and into its cavities; and when the arteries are to enter into the fubftance of the brain, they have already branched fo minutely upon the pia mater, that they enter into the pulpy fubftance in the moft delicate twigs; fo that having injected the brain, at whatever level you cut into it, you find its white furface dotted with red points regularly, and like the dots of a pin.

But in the lower animals, efpecially in the Calf, the Deer, the Sheep, which hang their heads in feeding, there is a provifion of fo fingular a nature, that we can have no doubt that thefe contortions of the great trunks and minute divifions of the fmaller arteries in Man have the fame final caufe; for in thofe creatures the carotid, before it enters the brain, firft divides into innumerable fmaller arteries. Not one of thefe is fent off for any particular function: they are immediately reunited again, and gathered together into one trunk; and then the force of the blood being thus broken, the artery divides a fecond time into branches of the ordinary form, which enter fafely into the fubftance of the brain.

It is ftill further fuppofed, that the arteries of the brain have this peculiarity, diftinct from all others in the body, that as they enter the fkull they lay afide one of their coats, and that of courfe the arteries of the brain are peculiarly weak. That the arteries of the brain want that outward coat of cellular fubftance which all arteries

passing

paſſing through other cavities or along the limbs have, is no doubt true, and ſo far they are thinner: but how much they are weakened by this loſs, it is not eaſy to ſay; for they want none of the coats which are eſſential to the conſtitution of an artery; and this cellular coat, though it conſtitutes much of the thickneſs of an artery, has, I believe, but little to do with its ſtrength. Yet true it is, that the arteries of the brain, either from being weaker in themſelves, being leſs ſupported, lying upon the ſoft and pulpy ſubſtance of the brain, are more frequently burſt by falls, or even by the ſlighteſt accidents, than the arteries of any other part, even the limbs, however much expoſed. Our injections burſt them very often; the ſlighteſt blow or fall upon the head often produces an internal effuſion of blood, which occaſions death; but that the arteries of the brain are ſo delicate as to be burſt by a falſe ſtep, ſo as to produce a fatal aneuriſm within the brain, is a truth perhaps not commonly known.

A young woman, carrying in her arms her firſt child, about ſix months old, ſlipped her foot with a ſlight ſhock; but it was on plain and even ground, and ſhe did not fall down. In the inſtant of this ſhock ſhe was ſenſible of a ſudden pain in the right ſide of her head: it was ſo peculiar, that ſhe ſaid ſhe could cover the point with her finger; and though ſlighter at intervals, this pain never left her to the moment of her death. She walked home, went about her little family-matters, ſuckled her child; but was ſeized that evening with ſickneſs, not violent like that of any ſudden diſeaſe, but rather like the eaſy vomiting of a pregnant woman.

She continued very ſick, with ſlight head-ach; but ſtill was out of bed all day long, went about her houſehold affairs, and had no ſymptom which could lead one to ſuſpect her very dangerous condition, or what a dreadful accident had happened. She got up during the night after this accident for ſome cool drink, felt herſelf extremely giddy, was obliged to ſupport herſelf by a cheſt of drawers which ſtood by her bedſide, and went to bed again immediately. On the evening of the ſecond day

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ſhe

fhe got out of bed, made tea as ufual, was out of bed during the evening, had no complaint, except the continual ficknefs, flight pain of the head, and giddinefs ftill flighter. That night fhe expired. Her pulfe all along had beat low and weak, and never more than 60 in the minute.

When I was brought to open the body, I heard nothing of the pain of her head, though it was fixed and conftant, and without that nothing could be more puzzling than this combination of circumftances. Firft, the fudden flipping of her foot, and the inceffant ficknefs which enfued, fuggefted the idea of hernia; but no fuch fecret was known among her relations; and upon opening the abdomen, no hernia was found, neither open nor concealed, as in the thyroid hole.

Next we were informed of a palpitation, which had been ufual with her. It appeared that fhe had complained chiefly about the period of her firft menftruation, and fome years before her marriage. It feemed to be hyfterical merely; but upon opening the thorax, we found the heart wonderfully enlarged and crammed with a dark and grumous blood.

But next a new fcene opened upon us; and this enlargement of the heart appeared to arife like that of the liver, which fo often accompanies fractured fkull, from the languid action of the heart and torpor of all the fyftem in thofe who lie even for a few days comatofe.

Now, for the firft time, I was informed that the fhock of flipping her foot had caufed a fudden pain of the head; that it was pointed, confined to one fingle fpot, inceffant, accompanied with perpetual vomiting or defire to vomit, and with giddinefs during the night.

Upon opening the head, I found the dura mater of a moft fingular appearance; livid, or rather like the gizzard of a fowl, with green and changing colours. Having cut it open the pia mater appeared like red currant jelly, with frefh coagulated blood fo firmly attached to it, that it feemed as if driven into its very fubftance and incorporated with it. Upon cutting and tearing open

VOL. II.   K   the

the pia mater, each convolution of the brain was fur-
rounded and feparated from that next it by coagulated
blood.   Upon cutting into the ventricles of the brain,
that of the right fide was found to contain four ounces
of entire and coagulated blood ; the cavity at firft view
was like opening a ventricle of the heart ; the blood,
very dark and firmly coagulated, was forced out by the
preffure of the furrounding parts ; the coagulum became
gradually firmer and whiter, till it turned to a very firm
ftringy clot, which ftuck in the mouth of the middle
artery of the brain.   Being carefully examined, it was
found to be fticking firm in the mouth of the artery
which had burft, as if by the feparation of two of its
rings.   The blood, which thus filled the right ventricle,
had alfo made its way down in prodigious quantity
into the third and fourth ventricles, quite into the
occipital hole ; but the oppofite ventricle it had not
filled.

The quantity of blood afcending to the head is ex-
ceedingly great ; its free circulation in all the arteries
is perfectly fecured ; and the plan of its diftribution is
extremely fimple, for the carotid entering by the os pe-
trofum gives three branches.   Firft, A branch which
unites the two carotids with the two vertebrals, and
forms the fore part of the circle of Willis.   Secondly,
It gives an artery to the great middle lobe, whence it is
named the great middle artery of the brain.   Thirdly,
An artery which is named anterior cerebri, as belonging
to the fore part of the brain.   But the vertebral, as it
arifes through the occipital hole, lies upon the cerebel-
lum, and fupplies all the cerebellum, and alfo the back
part of the brain.   One branch goes to the back part of
the cerebellum, another to the fore part of the cerebel-
lum, a third branch goes to the back part of the brain ;
and thus there is formed betwixt the carotid and the ver-
tebral, by means of the great inofculation of the circle
of Willis, one great fet of veffels : which fhould firft of
all be defcribed free from all the interruptions of trivial
arteries, which go off from point to point, but of which
the

the deftinations cannot be important, which are hardly
known, which do not go in any two fubjects the fame
way.

OF THE INTERNAL CAROTID ARTERY.

THE internal carotid artery leaves the external carotid
at the angle of the jaw : it is fo inclined to contortions,
that at this point it even bulges, and feems the outer-
moft of the two. In mounting along the neck, it is tied
by cellular fubftance to the fore part of the rectus or
ftraight mufcle of the neck, and it is alfo connected
with the par vagum and intercoftal nerve; the ganglion
of the intercoftal, or fympathetic nerve, lies by its fide ;
the nerve, before it forms this ganglion, comes down
fmall and thread-like through the fame canal by which
the carotid paffes into the fkull.

The contortions of the carotid are great, both before
and after its paffage through the bony canal ; but within
the canal it is forced to particular and fucceffive bendings,
fuch as indicate plainly fome defign of Nature ; for the
canal for the artery is long and tortuous, while the nerves
and veins pafs through plain and fimple holes. When
the carotid firft prefents itfelf to enter the fkull, it is
curved, and is a little behind its hole ; it bends forwards
and inwards a little, and fo enters the canal ; in enter-
ing the canal it rifes almoft perpendicularly upwards,
but foon bends forwards again, lying, as it were, upon
the floor of the canal ; then it bends again upwards and
forwards, to emerge from the canal ; by which turn the
portion of the artery which is engaged in the canal has
the form of an Italic f. Even after it gets into the fkull,
it muft ftill bend once more fidewife and forwards, as if
to meet its fellow, and to get to the fide of the fella tur-
cica ; then it goes directly forwards till it touches the
anterior clynoid procefs ; and then doubling back, or
returning upon itfelf, it rifes perpendicularly ; and fo
perpendicular is this laft turn, that when cut acrofs, the

mouth

mouth of the artery gapes perpendicularly upwards : here it begins to give its branches to the brain.

It is by the fide of the fella turcica that the CAVER-NOUS SINUS furrounds the artery. This finus is formed by the two plates or lamellæ of the dura mater, parting from each other, and leaving an interftice full of cells, like thofe of the penis or of the placenta. It is filled with blood, by communication with feveral of the fmaller finufes or veins about the bafis of the brain ; the oph-thalmic veins bring into it the blood from the eye ; four or five fmall veins defcending from the fossa Sylvii bring blood into it from the middle parts of the brain ; the finufes of the os petrofum (both on its upper and lower grooves) open into it, one high, another lower down, and that circular finus or vein which furrounds the root of the optic nerves opens into it from either fide. All this blood is poured into the cells, bathes the carotid ar-tery which lies naked in it ; and by the fide of the caro-tid artery lies alfo that fmall nerve of the fixth pair which begins the great intercoftal nerve, naked in the blood.

Veuffens firft difcovered this curious ftructure ; Ridley denied it, and Haller at laft in his turn confirmed it. Veuffens believed that the finus which depofited this blood conveyed it away again. Haller fays that this is the peculiar office of that vein which accompanies the carotid artery, and which is named the vena fodalis arte-riæ carotidis. It was once fuppofed that certain fmall arteries opened alfo into the finus ; but it has neither ar-teries, nor pulfation.

Thus we trace the carotid through its canal, through the cavernous finus, up to the fide of the fella turcica, and about to enter the brain, to give off the arteries of the brain. But before we defcribe thefe, it will be eafy to count fhortly thofe little twigs which it gives off in the canal and in the finus.

The carotid artery feldom gives out arteries before it enters the fkull ; it is a lufus naturæ, when it does hap-pen that the occipital or pharyngeal arteries come off from it.

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The firſt twig, which in any caſe it gives off, is ſome-times a ſmall artery, which returns downwards along with the upper maxillary nerve *; next a ſmall twig, ac-companied by a branch from the meningeal artery, goes into the tympanum by way of the aquæductus Fallopii; and next, while the artery is within the ſinus caverno-ſus, it gives out two little branches, the one forwards, the other backwards, named ARTERIES of the RECEP-TACULUM.

1. The little artery which goes backwards from the ſinus or receptaculum goes chiefly to that part of the dura mater which covers the poſterior clynoid proceſs, and which covers the cuneiform proceſs of the occipital bone; it gives twigs to the 4th, 5th, and 6th pair of nerves and to the pituitary gland; in ſhort, to all the parts at the back of the ſella turcica; it ends in inoſcu-lations with thoſe twigs of the vertebral artery, which come off from the vertebral before it enters the ſkull.

2. The little artery which comes out from the recep-taculum to go forwards, ariſes where the carotid is croſſed by the 6th pair, and has been miſtaken for a nerve by thoſe who ſuppoſe that the intercoſtal ariſes from a branch of the 5th pair. The diſtribution of this little artery is nearly the ſame with that of the firſt, for it belongs to the 3d, 4th, and 5th pairs of nerves and to the pitui-tary gland.

The carotid having riſen to the anterior clynoid pro-ceſs, gives out there a ſmall artery, no bigger than a crow-quill, which enters directly into the orbitary hole, accompanies the optic nerve into the eye, furniſhes the eye, the eyelids, the muſcles, and the lachrymal gland, and ſends out branches upon the forehead, viz. the fron-tal arteries in which it ends. This is a ſhort hiſtory of the OPHTHALMIC ARTERY; which, as it furniſhes all the arteries of the eye, muſt be deſcribed apart.

* The ſecond branch of the 5th pair.

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DIVISION OF THE INTERNAL CAROTID.

THE carotid, now about to enter into the brain, divides at the fella turcica into three arteries ; one to the fore lobe, another to the middle lobe, and a third to form the circle of Willis. Thefe arteries are ufually fo numbered that the communicating branch is firft defcribed, next the anterior artery of the brain, and laftly the middle artery of the brain. But of this arrangement no one who is accuftomed to obferve the courfe of this artery can entirely approve ; for when the carotid rifes from the fide of the fella turcica, it divides into its three branches all at once, in a tripodlike form : the middle branch of the tripod is largeft ; the next, which goes forwards to the fore lobe of the brain, is fmaller ; the third, which is the communicating branch, going backwards to unite with the vertebral artery and form the circle of Willis, is the fmalleft of all. The middle artery of the brain then is, from its great fize, to be regarded as the trunk.

I. ARTERIA MEDIA CEREBRI.

THE middle lobe of the brain is feparated from the anterior lobe by a very deep fulcus or furrow, which is named FISSURA SYLVII. This fiffura Sylvii is formed by the tranfverfe procefs of the fphenoid bone, or, in other words, by that very fharp line which runs out laterally from each of the anterior clynoid procefles, and which parts the fore lobe, which lies in the fhallow part of the fkull upon the orbitary procefles of the frontal bone, from the middle lobe, which lies in the deepeft part of the fkull behind the clynoid procefles. The MIDDLE ARTERY OF THE BRAIN having rifen from the fide of the fella turcica, runs ftraight along this foffa Sylvii, and is really the continued trunk of the carotid ; it is larger than the artery at the wrift ; it goes directly outwards, viz. towards the temple ; it runs along the foffa Sylvii, and is lodged deep in that cleft ; where it lies deep, it divides into two great branches, one deep and one fuperficial :

perficial : it gives fome branches to the anterior lobe, but it is chiefly limited to the middle lobe of the brain ; its branches to the pofterior lobe, or inofculations with any branches of the bafilar artery, are comparatively few.

Thus the artery ends by paffing into the fubftance of the brain. But nearer the fella turcica, and before it enters into the foffa Sylvii, it gives fome fmall and delicate arteries ; the confideration of which feems to be unimportant at firft view, but which is really ufeful in explaining the anatomy of the brain. It gives fmall twigs to the pituitary gland, to the optic nerve, to the tentorium, and efpecially to the pia mater covering the bafis of the brain. Among thefe fmall twigs certain fets of arteries make a very diftinguifhed figure.

1. There is one fmall artery which runs up into the anterior horn of the lateral ventricle, and forms that great plexus which lies along the floor of the ventricle, named PLEXUS CHOROIDES. This, then, is the ARTERY of the CHOROID PLEXUS.

2. There is a fet of arteries, of confiderable number, but varying in refpect of number, fmall as fewing threads, which inofculate repeatedly with each other, and which are fcattered widely and beautifully over the crura cerebri and bafis of the brain, forming in the pia mater a plexus or web of veffels. This part of the pia mater is named velum from its beauty and delicacy ; and this is what Wepfer, among other older authors, confidered as a fpecies at leaft of the rete mirabile : but that name implies a peculiar office, as in beafts, which this delicate net-work of veffels cannot have.

2. ARTERIA ANTERIOR CEREBRI.

THE FORE ARTERY of the BRAIN comes off from the middle artery at right angles nearly ; for the great or middle artery runs directly outwards towards the temple, while this fecond artery runs directly forwards along the fore lobe of the brain. It is named fometimes the artery of the corpus callofum, becaufe that of two great branches into which it is divided one goes to that

part of the brain.   The corpus callofum (a moft abfurd
name for any part of the brain) is the white and medul-
lary fubftance where the two hemifpheres of the brain
are joined ; and upon feparating the two hemifpheres
with the fingers, the corpus callofum is feen like a large
white arch, and the artery of the corpus callofum is feen
alfo arching over its furface.

The anatomy of the arteria anterior cerebri may there-
fore be explained thus : Firft it goes off at right angles
from the middle artery of the brain, which is to be con-
fidered as the trunk, and there it often gives fmall twigs
to the olfactory and optic nerves : next the two anterior
arteries of each fide, while they go forwards as if towards
the crifta galli, bend a little towards each other ; they
almoft meet, but do not abfolutely touch ; they form a
communication with each other, which of courfe is
exceedingly fhort, but pretty large. It is this fhort com-
munication which completes the circle of Willis at its
fore part.   This crofs communication betwixt the arte-
ries of the oppofite fides paffes juft before the fella tur-
cica and pituitary gland, and exactly in the middle it
fends off an artery, which goes down into the third
ventricle, and gives branches to the fore part of the
fornix and to the feptum lucidum.

After this communication, both arteries rife, with a
large fweep along the flat furface of that deep divifion
which the falx makes betwixt the two hemifpheres of
the brain ; there each divides into its two great branches ;
one attaches itfelf to the corpus callofum, or that arch
which we fee upon holding apart the two hemifpheres ;
it arches along with the corpus callofum fo as to defcribe
a femicircle ; it is the larger of the two branches ; it is
named ARTERIA CORPORIS CALLOSI : the other branch
keeps upon the flat furface of the brain, where the one
hemifphere lies flat upon the other, and it rifes in a
beautiful arch within the pia mater, dividing into beau-
tiful and very minute ramifications before it enters
actually into the fubftance of the brain.

Thefe two great branches of the anterior artery are
well diftinguifhed by Wepfer by the names of arteria
                                                        profunda

profunda and arteria fublimis (the deep and fuperficial of the anterior artery), as there is a deep and a fuperficial branch of the middle artery. The arch of the arteria anterior cerebri overhangs in a manner that of the artery of the corpus callofum, and both of them inofculate under the falx with the arteries of the oppofite fide.

3. ARTERIA COMMUNICANS.

THE COMMUNICATING ARTERY goes as directly backwards from the middle artery as the anterior artery goes forwards. It is fmall, proceeds backwards, and a little inwards; it goes round the fides of the corpora mamillaria, and is about a quarter of an inch in length before it meets the vertebral artery; and though it does give off fmall twigs, as to the infundibulum, to the optic nerve, to the crura cerebri, and efpecially one of greater fize, to the choroid plexus; yet all thefe are trivial arteries, fuch as every trunk at the bafis of the brain gives off. It is not its twigs that are to be obferved, but itfelf only that is important, as forming one of the largeft and moft important inofculations of the body. It unites the middle artery of the brain, which is the trunk of the carotid, with the pofterior artery of the brain, which is the firft and greateft branch of the vertebral artery.

This anaftomofis is the circle of Willis, too remarkable not to have been very long obferved; it was drawn by Veflingius and by Cafferius; it is but ill reprefented by Bidloo and by Cowper; it is not a circle, but is right lined, and of courfe angular: it is of very unequal fize; in one body it is large, in another fmaller, often even in the fame body; it is irregular, the one fide being large and the other fmall.

This inofculation brings us round to the firft branch of the vertebral arteries, viz. the ARTERIA POSTERIOR CEREBRI; for the vertebral artery gives two arteries to the cerebellum, and one to the back part of the brain.

OF

OF THE VERTEBRAL ARTERY.

THE vertebral artery, though but the fecondary artery of the head, is a principal one of the brain, and conveys a very great proportion of blood ; and its turnings and windings before it enters the fkull are almoft as particular as thofe of the carotid itfelf.   The vertebral is among the firft branches of the fubclavian artery, and comes off from it where it lies acrofs the root of the neck. The two lower ganglions of the fympathetic nerve lie over it, and their threads furround its trunk, making curious net-works round it.   The artery then enters into the canal prepared for it in the tranfverfe proceffes of the vertebra, commonly getting in by the 6th vertebra : but in this it is irregular, fometimes entering into the 7th or loweft ; and it has been feen entering into the uppermoft hole but one.   In this canal it afcends in a direct line from the bottom of the neck to the top ; but like the carotid it makes great contortions before it enters the fkull ; for when it has reached the fecond vertebra, its tranfverfe procefs being rather longer than thofe of the lower vertebræ, the artery is forced to incline outwards ; and the tranfverfe procefs of the atlas or firft vertebra being ftill much longer, the artery in paffing through it is carried ftill farther outwards ; it is forced to make a very fudden turn, and is vifible without cutting the bones.   When the artery has paffed through the tranfverfe procefs of the atlas, it makes another very fudden turn, lies flat upon the circle of that vertebra, fo as to make a large hollownefs or groove upon the bone, and then it enters the foramen magnum by rifing in a perpendicular direction ; and then again it bends and inclines forwards, laying flat along the cuneiform procefs of the occipital bone, where it foon meets its fellow, and the two uniting form the bafilar artery.

'This bafilar artery lies, with regard to the bone, upon the cuneiform procefs of the os occipitis, and runs along it from the foramen magnum to the fella turcica : with regard to the brain, it lies upon that great tubercle

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which

which is named the tuber annulare or pons Varolii; and as the artery goes along in one great trunk, it gives out from each fide little arteries, which belong to this tuber annulare,

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The brain has three arteries derived from the vertebral artery as it has from the internal carotid; two are given to the cerebellum and one to the cerebrum.

I. ARTERIA CEREBELLI POSTERIOR.

THE POSTERIOR ARTERY, or LOWER ARTERY of the CEREBELLUM, is fmall and not regular. It comes off from the bafilar artery either immediately after the union of the vertebrals, or from the vertebral artery immediately before the union. It is often fmaller on one fide than on the other, and fometimes it is wanting on one fide. It moves downwards in a fort of retrograde courfe betwixt the acceffory nerve of Willis and the group of fibres which form the eighth pair, and dives in betwixt the cerebellum and the medulla oblongata. Its larger branches fpread out upon the pia mater, and then enter into the medullary fubftance. They belong to the cerebellum, to the fpinal marrow, and fome of them to the pons Varolii. But there are alfo fmaller and particular twigs, as twigs to the eighth and ninth pairs of nerves: one alfo which enters into the fourth ventricle, to form a fort of velum or choroid plexus there: and as this pofterior artery winds downwards under the cerebellum, it gives many branches about the vermis, and fmall twigs which run betwixt the lower point of the pons Varolii and the pyramidal bodies.

Next the ARTERIA BASILARIS proceeds forwards along the pons Varolii in one great trunk: now the pons Varolii is juft the tuberofity produced by the crura cerebri and cerebelli, meeting and uniting to form the fpinal marrow. The corpora olivaria and pyramidalia are juft two bulgings at the root of the fpinal marrow; and

and as every great artery, whatever its deftination may be, gives twigs to thofe parts which it paffes over, fo does the bafilar artery; giving twigs firft to the corpora olivaria and pyramidalia, next to the crura cerebelli and to the crura cerebri; and as it runs along the pons Varolii it diftributes little arteries to it from right to left. Thefe little arteries alfo mark the fides of the pons with fmall furrows, which are feen when the arteries are diffected away. One of thefe tranfverfe arteries, longer than the reft, looks like another pofterior cerebri. It goes to the feventh pair, or auditory nerve, in the following way: The feventh pair of nerves proceeds from the back part of the pons Varolii; and as it goes forwards, the two nerves which it confifts of, viz. the portio dura and the portio mollis, are feparated from each other by a fmall and very beautiful artery which fhoots in betwixt them, and enters along with them into the ear. The bafilar artery alfo gives twigs to the fifth and fixth pairs of nerves, which arife from the fore part of the pons, as the feventh pair arifes from behind.

Arrived at the fore part of the pons Varolii, the bafilar artery gives off almoft at one point four great arteries, two to the right hand and two to the left. Thefe are the anterior cerebelli and the pofterior cerebri.

2. ANTERIOR CEREBELLI.

THE ANTERIOR ARTERY of the CEREBELLUM, or the upper artery, as it is called, goes off at right angles from the bafilar artery, and bends round the crura cerebri to get to the cerebellum. It gives its branches firft to the crura cerebelli, to the cerebellum, and to the vermis. Secondly, There is a greater artery going over all the upper part of the cerebellum, (where it lies under the brain,) and alfo another which keeps clofer to the brain than to the cerebellum, branches over that velum or delicate part of the pia mater which is interpofed betwixt the cerebellum and brain; and going along it fupplies the crura cerebri, and arrives at laft at the place of the nates, teftes, and pineal gland, and attaches
                                                              itfelf

itfelf to them. Some of the twigs go down into the fourth ventricle.

3. ARTERIA POSTERIOR CEREBRI.

THE POSTERIOR ARTERY of the brain goes off immediately after this, is like it, runs parallel with it, is larger, goes to the pofterior lobe of the brain, and receives near its root the communicating artery from the carotid, which forms the circle of Willis. Where this pofterior cerebri and the anterior cerebelli run parallel with each other, the third pair of nerves rifes betwixt them. The pofterior cerebri firft gives a fmall twig on either fide to the bottom of the third ventricle, which runs fo far forwards as to give branches to the thalami, centrum geminum, infundibulum, and to the crura fornicis. Then the main artery bending like that laft defcribed round the crura cerebri, and paffing deep into the great divifion betwixt the cerebellum and brain, arches upwards towards the back lobes of the brain; but before it arrives there, it gives firft fmall twigs to the crura cerebri, and then another notable artery (though fmall) deftined for the internal furfaces of the ventricles. This is a chief artery of the choroid plexus; it enters the lateral ventricle by the inferior horn; goes along with the cornu amonis: helps to form the choroid plexus; inofculates, of courfe, with the choroid arteries from the carotid; and twigs alfo go from this artery to the nates, teftes, and pineal gland, or in other words, to the velum which feparates the cerebellum from the brain, which clofes the ventricle behind, and which covers the pineal gland, and is a membrane or velum to it alfo; the pineal gland, nates, and teftes, being fituated neither in any of the ventricles, nor on the furface of the brain, but betwixt the furfaces of the cerebrum and cerebellum, where the one lies upon the other.

After this fecond branch to the internal furfaces, the great trunk of the pofterior cerebri branches profufely like a tree all over the back part of the brain, inofcu-

lating

lating forwards with the middle artery of the brain, and also with the artery of the corpus callofum.

Thus is the whole brain fupplied with blood ; and next in order come the arteries of the fpinal marrow.

§. 2. OF THE ARTERIES OF THE SPINAL MARROW.

I HAVE mentioned none of thofe fmaller arteries which the vertebral gives off before entering the fkull, becaufe being deftined chiefly for the fpinal marrow they belong to this fecond clafs.

The vertebral artery, as it mounts along its canal towards the head, gives at each ftep, or as it paffes each vertebra, a delicate twig ; thefe little arteries pafs through the intervertebral fpaces, go to the deeper mufcles of the neck, and inofculate with the thyroid and cervical arteries. In like manner, other fmall arteries go inwards to the fpinal marrow at the place where each nerve comes out. They enter into the fheath of the fpinal marrow, and inofculate with the chief arteries of the medulla fpinalis.

As the vertebral paffes through the atlas, both above and below that bone it gives out much larger arteries to the mufcles, as to the recti, trachelomaftoideus, and complexus, inofculating largely with the occipital artery : often there is at this point one large and particular artery going out to the back of the neck.

Again, as the vertebral paffes through the occipital hole, it gives out a litle artery, which accompanies the trunk itfelf up through the foramen magnum, and goes to that part of the dura mater which covers the cuneiform procefs, and there it inofculates with the twig of the carotid, which enters along with the jugular vein. This is the pofterior artery of the dura mater.

Next come the arteries of the fpinal marrow, the anterior of which comes out from the trunk of the vertebral artery ; the pofterior (though it alfo fometimes
                                                    comes

comes off from the vertebral before the bafilar is formed)
more commonly comes off from the pofterior cerebelli.

I. ARTERIA ANTERIOR MEDULLÆ SPINALIS.

THE ANTERIOR ARTERY of the fpinal marrow is the
larger of the two. It was difcovered firft by Willis; it
had been looked upon, till the time of Veuffens, as a
nerve accompanying the fpinal marrow; becaufe, when
empty of blood and uninjected, it is white, and not
unlike a nerve. This fpinal artery begins within the fkull
by two branches, which unite as they proceed down the
fpine. Thefe two branches arife one from each verte-
bral artery, at the very point where the vertebrals are
about to unite to form the bafilar trunk: each artery
paffes down its own fide of the fpinal marrow, betwixt
the corpora olivaria and the corpora pyramidalia; each
artery, before it leaves the fkull, gives twigs to the tuber
annulare, and to the pyramidal and oval bodies, for
they are the beginnings of the fpinal marrow; and
foon after emerging from the fkull *, the two fpinal
arteries join fo as to form one anterior fpinal artery.
This joining is ufually at the top of the neck, or rather
within the fkull, but fometimes fo low as the laft ver-
tebra of the back. Almoft always they join within the
head or near it; and the anterior fpinal artery which
they form defcends along the fpinal marrow in a furrow
which it forms for itfelf. The peculiar office of this
artery is to fupply the fpinal marrow and its fheath,
which it does by fending continual branches into the
fubftance of the fpinal marrow; while other branches
go into the fheath itfelf, and pafs out from the fpinal
canal along with thofe nerves which go out from the
fpinal marrow, accompanied by little proceffes of the
fheath, which are named proceffus denticulati.

But this artery, being extremely fmall, would be
foon exhaufted, were it not reinforced with fmall arte-

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* The artery which accompanies the ninth pair or lingual nerve,
often comes from the anterior fpinal artery.

ries

ries coming into the fheath : thefe pafs through the vertebral interftices into the fpinal canal, and are derived from every artery that paffes near the fpine. Thus in the neck the fpinal artery receives twigs from the vertebral arteries, and from the thyroid and cervical arteries ; in the back it receives twigs very regularly from each of the intercoftal arteries, and it receives its twigs from the lumbar arteries when it has got down as low as the loins.

But this fpinal artery which is continually diminifhing at laft fails in the loins ; and where the cauda equina begins, viz. in the canal of the os facrum, the medulla is no longer fupplied by a fpinal artery, but by the fmall branches of the facral arteries, which enter by the ten holes of the facrum.

Of thofe adventitious branches which reinforce the artery of the fpinal marrow as it defcends through the fpine, each gives feveral other branches ; they give twigs to the mufcles of the fpine, twigs to the fubftance of the vertebræ themfelves, twigs to the fheath of the fpinal marrow ; and, finally, twigs which inofculate with the fpinal artery, and which fink into the nervous fubftance to nourifh it.

2. ARTERIA SPINALIS POSTERIOR.

THE POSTERIOR SPINAL ARTERY differs in all effential points from the anterior : Firft, There are two pofterior fpinal arteries which arife, not from the bafilar or vertebral arteries like the anterior, but ufually from the arteria anterior cerebri ; and they are fmaller than the anterior fpinal artery : Secondly, Thefe two arteries give fmall twigs to the bottom of the fourth ventricle, and then go round from the fore to the back part of the medulla oblongata ; but there, inftead of uniting like the beginnings of the anterior artery, they continue feparate, run down the fpinal marrow as two diftinct arteries, with very frequent inofculations betwixt them. This artery is alfo unlike the other in refpect of its termination, for it difappears at the fecond vertebra of
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the loins. Its inofculations with the arteries from with-
out are very free.

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§. 3. ARTERIES OF THE EYE.

THE arteries of the eye come from one branch only,
the ophthalmic artery, the branch which the carotid,
when it touches the anterior clynoid procefs, fends into
the orbit along with the optic nerve. But fmall as this
original artery is (no bigger than a crow-quill), the fyf-
tem of arteries which arifes from it is very great ; whether
we confider their number, the irregular parts which they
fupply, or the great inofculations which they form even
with the outward arteries of the nofe and face.

Thefe are reafons for fetting this order of arteries apart ;
and even with all poffible care in the arrangement,
it is not eafy to deliver an orderly intelligible hiftory
of this artery. The ophthalmic artery fupplies not only
the eye itfelf, *i. e.* the globe, but it fupplies alfo all the
apparatus, if I may fo call it, of the eye, *i. e.* the muf-
cles, the lachrymal gland, the eye-lids, and even the
forehead and nofe.

1ft, It fends a great branch, which leaves the oph-
thalmic artery, and takes its own courfe outwards and
upwards along the eye, to fupply the lachrymal gland
where it is exhaufted. 2dly, The ophthalmic fupplies
the eye itfelf, both by that artery which enters into the
centre of the optic nerve, called arteria centralis retinæ,
and alfo by other arteries which are named the ciliary
arteries ; becaufe they go onwards to the fore part of
the eye, where the ciliary circle is. 3dly, The mufcles
are fupplied by an artery which comes from the fame
place nearly with thofe ciliary arteries. 4thly, There
are two arteries which go down through holes in the
focket into the bones and cavities of the nofe ; and thefe,
as they perforate chiefly the æthmoid bone, are named
æthmoidal arteries. 5thly, and laftly, Thofe arteries

which go out upon the forehead and nofe are fo directly from the trunk of the ophthalmic artery, that they muft be regarded as the termination of it.   This is the fyftem of veffels which comes now to be defcribed, and this is, perhaps, the beft order for the defcription.

FIRST ORDER.

I. ARTERIA LACHRYMALIS.

The lachrymal artery is the firft branch of the ophthalmic; but, in order to know its place correctly, we muft firft obferve how the ophthalmic artery enters, the eye.   It comes off from the carotid, where that artery touches the clynoid procefs; and is fo clofe upon the procefs, that the fetting off of the ophthalmic is almoft covered by that projection.   It then dives under the optic nerve, and appears on the outer fide of it; and as the artery goes along through the orbit, it makes a fpiral turn till it completely furrounds the nerve.

The lachrymal artery goes off from the ophthalmic immediately after entering the orbit*, though fometimes it arifes from the artery of the dura mater; and then it enters by the foramen lacerum, which is the next opening to the optic hole.   It goes off from the ophthalmic about two or three lines after it has entered the focket. It goes all along the outer fide of the orbit, becaufe the lachrymal gland lies in the outer corner of the eye. When it reaches the gland, it is branched out and entirely expended upon it, except that it fends fome fmall twigs forwards to the eyelid.   Of thefe vagrant branches, one twig goes to the periofteum of the orbit, perforates the cheek-bone, and fo gets into the hollow of the temple, inofculating with the deep temporal artery; while another little branch goes to the tarfus of the upper eyelid, and another to the tarfus of the lower eyelid, and thus ends the lachrymal artery.

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* Sometimes it goes off one or two lines before the ophthalmic enters the optic hole, fometimes from the middle of the artery.

SECOND ORDER.

In the fecond order are included the arteries which go to the eye itfelf, viz. the ARTERIA CENTRALIS RETINÆ, and the CILIARY ARTERIES ; of which arteries there is none more curious than the arteria centralis retinæ.

I. ARTERIA CENTRALIS RETINÆ.

THIS artery is fo named becaufe it perforates the optic nerve, runs up through its very centre or axis, enters into the cavity of the eye through the very centre of the optic nerve, and fpreads its branches all over the retina. It ufually arifes from the ophthalmic artery, where it turns in the middle of the orbit over the upper part of the optic nerve * ; it plunges into the nerve ; and this artery, or rather the artery and vein, both (for the vein accompanies it) make fo large a canal in the centre of the optic nerve, that it ftands quite open and gaping when the nerve is cut acrofs ; and was long known to the older anatomifts by the name of porus opticus, before the meaning of this orifice or hole was underftood.

When this artery arrives within the eye, it branches out moft beautifully upon the retina. The angles and mefhes which this artery makes give the name of retina or net-like to the whole ; for the pulpy part of the optic nerve expands into a very thin and delicate web which refembles mucus. This web has all its ftrength from thefe branches of the central artery. The branches of the artery, and the mucus-like expanfion of the nerve, lie in two feparate layers; and hence fome anatomifts reckon the retina a double membrane.

The arteria centralis having given off fidewife thefe innumerable branches to the retina, ftill goes forwards, plunges through the fubftance of the vitreous humour, does not ftop till it arrives at the back part of the lens, and is of courfe the ARTERIA CENTRALIS OCULI, the

* It may be found arifing from the ciliary arteries, or fometimes from the mufcular.

central

central artery of the eye itfelf. This central artery can no more be feen in the adult eye than the arteries of an unprepared bone; but by injecting the fmall arteries of the eye of a fœtus, of a flink Calf, or of any young animal, the arteria centralis oculi is found to diftribute its branches in the following way: As it goes forwards through the centre of the eye-ball, it gives off its delicate arteries from fide to fide, which go along the partitions of the vitreous humour (for the vitreous humour is divided every where by membranes into fmall honey-comb-like cells). Thefe crofs arteries inofculate with thofe of the retina, and are plainly the arteries which fecrete and fupport the vitreous humour. The central artery ftops when it comes to the back of the lens: it is fcattered in a radiated form, as if by the refiftance, into a great many branches. Thefe branches go round all the capfule of the lens, and meet again on its fore part; where, uniting into one or more fmall arteries, they pafs onwards into the opening of the pupil, and help to form that membrane which in the fœtus fhuts out the light, protects the eye, and vanifhes very gradually.

So the arteria centralis retinæ paffes firft through the centre of the optic nerve; next through the centre of the vitreous humour; next, after going round the capfule of the lens, it paffes through the pofterior chamber of the aqueous humour, and terminates in the centre of the pupil. But as thefe laft arteries, viz. of the pupil, vanifh foon after birth, we may confider the central artery as ending in inofculations with thofe arteries, which coming upwards along the fides of the eye along with the retina, form a ftrong circle of arteries at the root of the ciliary procefs.

2. ARTERIÆ CILIARES.

THE ciliary circle is known, upon looking outwardly at the eye, by that white line which borders the iris, and feparates the iris or coloured part of the eye from the white or colourlefs part. That circle marks the place where there is a great concourfe of arteries. The corpus

pus ciliare, or ciliary body, is the part within the eye which lies flat upon the fore part of the vitreous and cryſtalline humours, which is like a ſecond iris behind the firſt, which is extremely vaſcular, and correſponds with the ciliary circle without. This corpus ciliare is radiated (that is a conſequence of the peculiar order and arrangement of its veſſels, which run in rays from the ciliary circle, *i. e.* from the circumference towards the centre). Theſe radii coming from the ciliary circle are called the ciliary proceſſes; ſo that the ciliary circle, corpus ciliare, and ciliary proceſſes, are all parts of the ſame vaſcular organ. This is the part of the eye to which all thoſe arteries go which are next to be deſcribed.

1. Two arteries of conſiderable ſize go off from the ſides of the ophthalmic artery: theſe go along the ſides of the optic nerve; they go towards the ball of the eye; and the one on the outer ſide of the eye is named EXTERNAL CILIARY ARTERY, that on the inner ſide of the optic nerve is named the INTERNAL CILIARY.

2. Theſe two divide themſelves again into two ſubordinate branches: one of them as ſoon as it touches the eye, that is, juſt beyond the implantation of the optic nerve, enters its ſubſtance, and is ſpread out on its choroid coat in a great number of branches, which are named CILIARES BREVES, the ſhort ciliary arteries: the other goes further forward upon the eye before it enters, and even after it enters, it ſtill goes forwards to the very fore part of the eye before it divides; hence named CILIARES LONGÆ.

3. The ANTERIOR CILIARY ARTERIES are ſome ſmall and uncertain branches, which come ſometimes from one ſource, ſometimes from another, but moſt commonly from the muſcular branches; and they go along with the muſcles, and conſequently enter the eye at its fore part juſt where the recti muſcles are inſerted. But, though ſmall, theſe anterior ciliary arteries are of conſiderable number.

From the places at which theſe ſeveral arteries enter

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the ball, one might guefs a priori how they will be dif-
tributed through its coats.

The ciliary arteries do not all of them arife from
the ophthalmic artery; many arife from the mufcular
branches. As foon as they touch the eye-ball, they enter
into it near the infertion of the optic nerve, pafs through
the fclerotic coat (leaving for its nourifhment a few
twigs); they divide fo, that juft after they have entered,
we can count twenty-five or thirty all round the root of
the optic nerves, which go forwards in a radiated form,
and are completely diffufed upon the choroid coat; thefe
are the POSTERIOR CILIARY ARTERIES. This coat of
veffels lines the choroid all the way forward to the lens,
goes ftill onwards to the fore part of the lens; and then
turning down upon the lens at right angles, it meets with
the anterior veffels, and forms the ciliary circle, and the
ciliary proceffes or radii; a few twigs go ftill forward
upon the uvea and iris, fo as to make a very important
connection of all the vafcular parts of the eye.

Secondly, The LONGER CILIARY ARTERIES enter the
fclerotic a little further forward, and penetrate at a greater
diftance from the optic nerve. They are two arteries thus
diftinguifhed; they pafs forward betwixt the fclerotic
and choroid coats, and on approaching the ciliary circle,
they each divide and make a circle of inofculation. Their
branches meet each other, and are now joined both by
the fhorter ciliary arteries and by the anterior ciliary arte-
ries; by which conjunction an arterial circle is formed,
which correfponds with the outer circle of the uvea, and
is called the OUTER CILIARY CIRCLE: this again fends
radii of veffels, perhaps thirty, inwards, which meeting,
form a fecond circle, the INNER CILIARY CIRCLE.

Thirdly, The anterior ciliary arteries enter the eye at
its fore part, and immediately unite with thefe, as has
juft been explained; they help to form the ciliary circle,
which is the great conjunction of all the internal veffels
of the eye.

THIRD ORDER.

In this order are included the MUSCULAR ARTERIES, which are the leaft regular of all the branches of the ophthalmic artery. From one or other branch of the ophthalmic there generally arife two mufcular arteries; the one for the upper, the other for the lower mufcles.

1. ARTERIA MUSCULARIS SUPERIOR.

THE UPPER MUSCULAR ARTERY confifts of fmall twigs, which go chiefly to the levator palpebræ and rectus fuperior; and thefe, though they fometimes arife as two fmall twigs from the ophthalmic artery itfelf, yet in general come off rather from that artery which, as it goes out by the fupra-orbitary hole, is named the fupra-orbitary artery. Thefe mufcular branches of the fupra-orbitary, then, fupply the upper mufcles of the eye, as the levator palpebræ, the obliquus major, the rectus fuperior, and the fclerotic or outer coat of the eye.

2. ARTERIA MUSCULARIS INFERIOR.

THE LOWER MUSCULAR ARTERY is very generally an independent artery, and pretty large. It comes off from that part of the ophthalmic artery where it is giving off the ciliary arteries. This mufcular branch is large enough to give off fometimes the arteria centralis retinæ, and often fome of the fhort ciliary arteries arife from it; it is fo long as even to reach the lower eyelid. The mufcles which it fupplies are all thofe which lie on the lower part of the eye, as the deprimens oculi, abducens oculi, obliquus minor. It alfo gives variable twigs to the fclerotica, the optic nerve, the periofteum of the orbit, and fometimes to the adnata and lower eyelid.

FOURTH ORDER.

THE set of arteries which ftand next in order are thofe which go down into the nofe through the æthmoidal bone, whence they are named æthmoidal arteries. The æthmoidal arteries are, like the other branches of the ophthalmic, pretty regular in their deftination, but far from being regular in the manner in which they arife.

1. ARTERIA ÆTHMOIDALIS POSTERIOR.

THE POSTERIOR ÆTHMOIDAL ARTERY is fo named becaufe it paffes through the pofterior of two holes which are in the orbit at the joining of the æthmoidal with the frontal bone *. It is an artery by no means regular in its place, coming fometimes from the ophthalmic trunk, fometimes from the lachrymal artery, very rarely from the fupra-orbitary artery. It is of no note : it is the fmaller of the two æthmoidal arteries ; it goes through its hole, and is fcattered upon the bones and membranes of the nofe. While it is circulating its twigs among the æthmoidal cells, it inofculates, of courfe, with the nafal arteries of the external carotid.

2. ARTERIA ÆTHMOIDALIS ANTERIOR.

THE anterior æthmoidal artery is rather more regular and more important ; it paffes through a larger hole, and is itfelf larger ; it comes off more regularly from the ophthalmic trunk, and it goes not down into the nofe, but upwards into the fkull.

The ophthalmic artery, much exhaufted by giving off many branches, has rifen over the optic nerve, has completed its fpiral turn, and has juft got to the inner corner of the eye, where the æthmoid hole is, when the anterior æthmoid artery arifes from it. It arifes juft behind the pulley of the upper oblique mufcle, plunges immediately into its peculiar hole, and, paffing along a canal

* In defcribing the fkull, thefe are named the internal orbitary holes.

within

within the æthmoid bone, it merely gives twigs to the frontal and æthmoidal finufes, and paffes up by one of the largeft holes in the cribriform plate of the æthmoid bone. When within the fkull, it is under the dura mater, betwixt it and the bone; it goes to the dura mater and to the root of the falx, and fome of its delicate twigs turn downwards again into the nofe, through the fmall holes of the cribriform plate accompanying the branches of the olfactory nerve.

FIFTH ORDER.

The fifth order of arteries is very numerous, including all thofe which fend their twigs outwards upon the face. They are the fupra-orbitary artery, the artery of the upper eyelid, the artery of the lower eyelid, the artery of the forehead, and the artery of the nofe.

1. ARTERIA SUPRA-ORBITALIS.

The fupra-orbitary artery is fo named from its emerging from the focket by that notch in the fuperciliary ridge which we call the fupra-orbitary hole. It comes off from the ophthalmic artery at the place where it gives off the ciliary and lower mufcular arteries: it fo often gives off the arteries which go to the upper mufcles of the eye, that fome have named it the fuperior mufcular artery. It paffes onwards, giving twigs to the levators of the eye and of the eyelid, and to the upper oblique mufcles, and to the periofteum; and before it arrives at the fupra-orbitary hole, it divides into two twigs; of which one lies deep, and fupplies the periofteum of the forehead, inofculating with the temporal artery; the other lies more fuperficial, but ftill is covered by the orbicularis and corrugator fupercilii, on which mufcles it beftows all its branches.

2. ARTERIÆ PALPEBRALES.

The two PALPEBRAL ARTERIES arife from the ophthalmic after it has paffed the tendon of the obliquus fuperior,

rior, when it has in a manner emerged from the focket, and is lying at the inner angle of the eye : there it commonly gives off two fmall arteries, one to the upper and one to the lower eyelid ; and often the two arife by one trunk.

. ARTERIA PALPEBRALIS INFERIOR.——The ARTERY of the LOWER EYELID is the branch of the two which goes off the firft ; but it is the fmaller and lefs regular of the two. Its twigs go, one to the union of the two tarfal cartilages, to the caruncula lachrymalis, and to the adjoining part of the adnata ; another goes deeper, viz. to the lachrymal fac, and even into the æthmoid cells ; and a third twig runs along the margin of the tarfus, named tarfal artery, fupplying the Meibomean glands.

ARTERIA PALPERALIS SUPERIOR.——The ARTERY of the UPPER EYELID arifes along with the lower palpebral, or near it ; it gives few branches ; one keeps to the angle of the eye, and fupplies the orbicularis oculi, the caruncula, and the tunica conjunctiva ; another having pierced the fibres of the oblique mufcle, runs along the borders of the tarfus, inofculating with a fimilar branch of the lachrymal artery, and forming an arch along the upper tarfus as the other does below.

3. ARTERIA NASALIS.

THE NASAL ARTERY goes off at the edge of the orbit, rifes over the lachrymal fac, and over the ligament of the eyelids ; it firft gives a twig upwards to the root of the frontal mufcle ; then another goes down over the lachrymal fac, and after giving branches to the fac, goes to the orbicularis mufcle, and inofculates with the infra-orbitary artery ; and laftly, the moft remarkable branch of this artery, from which indeed it has its name, runs down upon the fide of the nofe, making a beautiful network, and inofculating with the laft branch of the labial artery, called angularis, which runs up to meet it *. This

* Some of its branches abfolutely penetrate the cartilages of the nofe, and fo get accefs to the Schneiderian membrane, and fupply it with blood.

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is quite a cutaneous artery; many of its twigs go to the skin, it is felt beating ftrongly; it was often opened when arteriotomy was more regarded than it is now.

4. ARTERIA FRONTALIS.

THE FRONTAL ARTERY is now to be diftinguifhed from the fupra-orbital; for the fupra-orbital rifes deep in the focket, emerges by the fupra-orbitary-hole, paffes along chiefly betwixt the bone and mufcles, and makes no remarkable figure upon the face; while this, the frontal artery, keeps chiefly upon the furface of the mufcles, is quite fubcutaneous, has nothing to do with the fupra-orbitary hole, and rifes beautifully upon the forehead. It is a delicate and flender artery, not fo large as the nafal, and looks like one of its branches; it gives off firft a branch to the eye-lids, named fuperciliary artery, which fupplies the root of the frontal and the upper part of the orbicularis mufcles; it fends an afcending branch which dives under the frontal mufcle, and belongs chiefly to the os frontis and pericranium. This is the little artery which often makes a perpendicular groove in the os frontis. The chief branch of the artery continues fubcutaneous, is felt beating along the forehead, belongs chiefly to the fkin of the forehead and to the hairy fcalp, and mounts to the top of the head, to the place of the fontanelle, where it has free inofculations with the temporal artery.

This laft branch is the end of the occular or opthalmic artery, of which the branches are fo irregular in their origin, that the moft diligent anatomifts have declined that part of the defcription, and yet have arranged the branches upon that fcheme, viz. the points from which the feveral twigs arife: whereas I have thought it more prudent, fince the branches are regular in refpect of the parts which they fupply, to arrange them according to thofe parts, viz. the lachrymal gland, the eyeball, the mufcles, the æthmoid cells, the face; an order which alfo very nearly correfponds with the order in which the arteries arife. The learning and re-

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membring thefe arteries, it is right to acknowledge, is a tafk more difficult than ufeful ; more fuiting the fevere anatomift, than the practical furgeon ; who yet, if he do his duty, will learn all ; and as he learns much, muft expect to forget much.

CONCLUSION.

BEFORE I leave this difficult fubject, I ftop one mo- ment to explain a point which might leave fome con- fufion in the reader's mind ; and regarding chiefly thofe little arteries which belong to the membranes of the brain.

It is of great importance in ftudying the brain, to know the manner in which its membranes are connected with it ; and it is efpecially to be remarked, that the internal furfaces, or, in other words, the cavities of the brain, need to be fupported, nourifhed, and fupplied with blood as much as the external furface ; and that for this end the pia mater turns inwards and lines all the cavities of the brain.

At different points the pia mater and its arteries take various forms, and are called RETE MIRABILE, VELUM, or CHOROID PLEXUS, according to that form.

The RETE MIRABILE has already been explained, as being that divifion and reunion of the branches of the carotid artery by which the force of the afcending blood is broken before it enters the brain. In many of the lower animals this provifion of nature is moft curious and particular ; but in Man it would appear, that the erect pofture in which he walks, the contortions of the carotid artery as it enters the fkull, the manner in which it lies in the cavernous finus, and, finally, the minute divifion which it undergoes by fpreading over the pia mater before it enters the brain, are fufficient. In Man there is not the fmalleft veftige of a rete mirabile ; and whenever we find a rete mirabile defcribed in Man (as
                                                              often

often it has been defcribed), we find invariably that it means no more than the plexus of delicate veffels which go out from the firft twigs of the carotid artery, either to fupply the membranes or to enter into the cavities of the brain ; and accordingly we find thefe authors calling it " a beautiful beginning of a rete mirabile ;" " an imperfect rete mirabile," &c.

The VELUM, as it is called, is that netted form which the pia mater affumes often about the bafis of the brain, whenever the fmaller arteries are numerous ; for the inofculations of the arteries are like a net-work ; the arteries, full of blood or of injection, are opaque and are very apparent ; while the membrane upon which they run is lucid, diaphanous, and is fcarcely feen. A velum or net of this kind appears on every fmooth and uniform furface of the bafis of the brain ; but the moft remarkable of all is that which, beginning betwixt the cerebrum and cerebellum, is continued forward to the very centre of the brain betwixt the fornix and the third ventricle, extending from the plexus choroides of one fide to the other. This is called the VELUM INTER-POSITUM.

The PLEXUS CHOROIDES again is merely another variety or form of the pia mater. The great choroid plexus is a membrane which lies upon the bottom of each lateral ventricle : it is netted and extremely vafcular, not unlike the chorion of fome animals, whence it is named. It confifts partly of arteries, but chiefly of veins ; it conveys fome blood to the internal furfaces of the brain, but returns much more.

But although the choroid plexus of the two lateral ventricles be the chief ones, the third and the fourth ventricles have each their plexus or vafcular webs. The chief points by which thefe vafcular webs of the pia mater enter are by the anterior and pofterior horns of the lateral ventricles ; at which points, and indeed at all the lower parts of the brain, the ventricles muft be confidered as fhut, fince thefe vafcular linings, as they enter, adhere on all fides : but may alfo be confidered as open, fince they admit thefe membranes, fince they

are

are fhut only by their flight adhefion, and may be opened by pulling the parts gently afunder.

This, then, is a general explanation of that vafcular part of the pia mater which covers all the bafis, and lines all the cavities, of the brain. It is one continuous membrane, under the various titles of rete mirabile, which fome older anatomifts ufe; of velum, a name chiefly repeated by Haller; and of plexus choroides, a name univerfally ufed for that net-work of veffels which lies out upon the floors of the ventricles. It will be feen hereafter how greatly a knowledge of thefe inflections contributes to the right underftanding of the brain and its parts and cavities.

CHAP. II.

OF THE ARTERIES OF THE ARM.

THE fubclavian arteries arife from the arch of the aorta. The left fubclavian arifes from the extremity of the arch, and juft where the aorta is turning down towards the fpine. It is longer within the thorax, runs more obliquely to pafs out of the cheft, receives in a lefs favourable direction the current of the blood. But the right fubclavian arifes from the aorta by that artery which is called the ARTERIA INNOMINATA; for it is an artery which can have no name, being neither the carotid nor the fubclavian, but a trunk common to both. It is large, rifes from the top of the aortic arch, receives the blood in the moft direct manner; from which phyfiologifts have deduced thofe confequences which have been already explained *.

1. The artery of the arm, as it proceeds, changes its name according to the parts through which it paffes. It

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* Douglas fays the left is fhorter, which I can by no means underftand.

is

is named fubclavian within the breaft, axillary in the arm-pit, brachial as it goes down the arm, and when it divides at the bending of the arm its two branches are named the radial and ulnar arteries, after the radius and ulna, along which they run, until at laft they join to form vafcular arches in the palm of the hand.

Nature has thus arranged and divided the parts of this artery; and the ftudy of its branches becomes eafy to thofe who will firft condefcend to obferve this fimple arrangement and the parts through which it goes. 1ft, While the artery is within the breaft, it lies tranfverfely acrofs the root of the neck; it fupplies the neck, the breaft, the fhoulder; it gives all its branches upwards into the neck, or downwards into the breaft: upwards it gives the vertebral to the infide of the neck (if 1 may ufe an expreffion which cannot now be mifunderftood); the cervical, which goes to the outfide of the mufcles of the neck; the thyroid, which goes to the thyroid gland. While it gives off from its oppofite fide down-wards, and into the cheft, the mammary, which goes to the inner furface of the breaft; the upper intercoftal artery which ferves the fpace betwixt the uppermoft ribs; the mediaftinum and pericardium and even the diaphragm, though far diftant, receives branches from this mammary artery.

2. When the artery, having turned over the floping part of the cheft, glides into the axilla, and lies deep there betwixt the fcapula and the thorax, what parts can it fupply, or what veffels can it give off, but fca-pular and thoracic arteries? Its branches accordingly are three or four flender arteries to the thorax on one hand, named the four thoracic arteries, which give twigs to the glands, the pectoral mufcles, and the breaft or mamma; and on the other hand it gives off firft great articular arteries which furround the joint, and ftill great fcapular arteries which furround the fcapula, and nourifh all that great mafs of flefh which lies upon it.

3. But when this artery takes the name of the humeral artery, and paffes along the arm, it muft be fimple, as the arm is fimple; for it confifts of a bone

2   of

of one mafs of mufcles before and another behind : the artery of courfe runs along the bone undivided, except that it gives off one branch, which runs parallel along with the main artery, and which running deeper among the flefh, is named mufcularis or profunda.

4. It divides at the bend of the arm, in order to pafs into the fore-arm in three great branches. In wounds thus low, all danger of lofing the arm from wounds of the artery, unlefs by the grofs ignorance or fault of the furgeon, is over : we do not attend fo much to the parts which it fupplies, or, in other words, to its inofcula-tions, as to the parts againft which the great branches lie. We obferve here, as on all occafions, the artery feeking protection, and running upon the firmeft parts : its three branches now pafs; one along the radius, another along the ulna, a third along the interofleous membrane.

5. In the palm of the hand we find the artery ftill following the order of the bones ; and as the carpal bones are as a centre or nucleus, upon which the meta-carpal and finger bones ftand like radii, the palmar artery forms a complete arch, from which all the fingers are fupplied by arteries, iffuing in a radiated form.

Of all thefe fubdivifions the fubclavian artery is that which feems the leaft important to know ; and yet without a perfect knowledge of it, how fhall we under-ftand many important arteries of the neck or fhoulder ? How fhall we underftand the anatomy of the greateft of all the nerves, viz. the fympathetic nerve which twifts round it ? How fhall we judge rightly of tumours near it, or of aneurifms which fo often mount along this artery from the arch of the aorta until they are felt here ?——Of the fecond divifion of the artery, viz. where it lies in the axilla, the importance is moft un-equivocal ; fince every attempt to ftop hæmorrhages, by compreffing this artery, requires a knowledge of it ; fince every full bleeding wound near this place alarms us, and requires all our knowledge ; fince every tumour that is to be extirpated opens fome of its branches ; fince

we

we cannot cut off a cancerous breaft, or the glands which fhould be taken along with it, without cutting the thoracic arteries.—Next the artery of the arm, fimple as it is, interefts us greatly. It is this fimple artery which is hurt in aneurifms; it is its delicate, I had almoft faid capillary, branches, which are to efta-blifh a new circulation, and to fave the limb. We have indeed no apprehenfions of lofing the limb for want of blood (the continual fuccefs of our operations having eftablifhed this point); yet it is moft interefting to obferve the extreme fmallnefs of thefe branches, as an affurance to us in other cafes of danger; though I do indeed believe, that there cannot in any fimple wound in any limb be the fmalleft danger from this much dreaded obftruction of the blood.

The arteries of the fore-arm are more interefting ftill; for if we will be fo felfifh as to confider the difficulties of the furgeon merely, wounds of the arteries in the fore-arm are very diftreffing. Thefe arteries lie deep among the mufcles, drive their blood (when wounded) through the whole arm, and either occafion a difficult and moft painful diffection, or caufe a deep and gan-grenous fuppuration; fo that whether the furgeon be fo dexterous as to fecure the arteries, or fo timid as to leave the arm in this woeful condition, the patient is to undergo fuch fufferings by pain, or by a long difeafe, as muft intereft us greatly.

The arteries even of the wrift and hand, though fmall, are important. The difficulty of managing wounds of thefe arteries ftands but too often recorded in all kinds of books for us to doubt the fact. If many have died after frequent bleedings from thefe arteries, though under fkilful hands, what ought we not to fubmit to in the way of ftudy and labour to acquire and to retain a knowledge of thefe arteries; fince by that alone every thing that is furgical in tumours, aneurifms, amputa-tions, is well or ill performed according to our degree of knowledge; and fince, according to our degree of knowledge, we are difengaged in our minds, and have free polleffion of our judgment, to do any thing which

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may

may be required? In fhort, as we proceed along this artery, we fhall perceive that each divifion of it rifes in importance; or at leaft, that if wounds about the axilla be more dangerous, they are proportionably rare; that if accidents about the wrift or hand be lefs dangerous, they are, however, more frequent, fo as to deferve every degree of attention.

I. OF THE SUBCLAVIAN ARTERY.

THIS artery is fo named from its paffing under the clavicle by which it is protected; and we include under this divifion all that part of the artery which lies betwixt the arch of the aorta and the outfide of the clavicle, where the artery comes out upon the cheft. Here the artery is of a very great fize; it lies directly acrofs at the top of the cheft and root of the neck; and like a cylinder or axis, it gives its branches directly upwards and directly downwards to the throat, to the neck, and the parts within the cheft. Upwards it fends the vertebral, the thyroid, the cervical, and all the humeral arteries; downwards it fends the upper intercoftal artery, and alfo the internal mammary, which, befides its going along the inner furface of the cheft, gives branches to the pericardium, mediaftinum, thymus, and other parts.

I. ARTERIA MAMMARIA INTERNA.

THE INTERNAL MAMMARY ARTERY is the firft which the fubclavian gives off; it is of the fize of a crow-quill, long, flender, its ramifications very beautiful. On each fide of the cheft the mammary artery paffes down along all the inner furface of the fternum, and ends at the cartilago enfiformis in numerous inofculations with the epigaftric artery; for the epigaftric arifes from the femoral at the groin, juft as this does from

from the fubclavian at the top of the cheft, and runs upwards along the belly, as this the mammary runs downwards along the breaft till they meet each other midway. This is an inofculation, which fifty years ago was much noticed. Phyfiologifts deduced the moft important confequences from it, afcribing the connection of the breaft and womb to the flux and reflux, to the alternate ftoppage and acceleration of the blood in thefe veffels; although the fympathy of the breafts and womb is plainly a connection which Nature has eftablifhed upon other laws, upon a kind of fympathy fuch as we fee everywhere in the fyftem, but can in no inftance explain.

The courfe of the mammary artery, and the order of its branches, is this: It goes off from the lower and fore part of the axillary artery; it lies on the outfide of the membranous bag of the pleura; and confidering the pleura as ending in an obtufe and rifing apex, the mammary artery lies at firft a little behind the pleura, its firft movement is to rife and turn with an arch over the top of the pleura or bag which inclofes the cavity of the cheft; there it defcends again, and paffes betwixt the ribs and pleura; the artery runs along the infide of the thorax under the middle of the cartilages. At the feventh or eighth rib the mammary itfelf emerges from the thorax, and becomes an external artery; it firft fends a branch towards the enfiform cartilage, which plays round it, and then it goes to the upper part of the abdominal mufcles by two diftinct branches, the one of which is internal, the other external. The internal branch goes into the belly or fubftance of the rectus mufcle, defcends nearly as far as the navel, and inofculates with the epigaftric artery. The external branch turns off to one fide, goes rather to the lateral mufcles of the abdomen, efpecially to the two oblique mufcles, and it inofculates more with the lumbar arteries; and fo the mammary ends. But as it paffes down along the cheft, it gives the following branches:

Firft, Where it is paffing the clavicle, bending to go downwards, it gives a fmall retrograde branch which

follows

follows the courfe of the clavicle, and goes to the muf-
cles and fkin of the neck *.

Secondly, It gives an artery, or rather arteries, to the
thymus, ARTERIÆ THYMICÆ. Thefe are in the adult
extremely fmall, becaufe the gland itfelf is fo ; but in the
child the gland is large, the upper part lies before the
trachea, the lower part lies upon the heart, or rather
upon the pericardium betwixt the two lobes of the lungs :
the upper end then is fupplied by the thyroid arteries ;
the middle part is often fupplied by a diftinct and particu-
lar branch, viz. by this ARTERIA THYMICA coming from
the mammary, but this is far from being always fo ; the
loweft part of the gland has twigs from thofe arteries
which properly belong to the mediaftinum, upon which
it lies, or to the pericardium, or to the diaphragm.

Thirdly, The mammary gives alfo the upper artery of
the diaphragm, its lower artery being the firft branch of
the aorta within the abdomen. This upper artery of the
diaphragm is named ARTERIA COMES NERVI PHRENICI,
becaufe it accompanies the phrenic nerve. The phrenic
nerve is paffing from the neck (where it arifes) into the
cheft, by the fide of the axillary artery, when it receives
from the mammary this fmall artery which goes along
with it ; and this artery (which is fo extremely fmall that
nothing but its regularity can give it any importance)
goes down through the whole cheft, accompanying the
phrenic nerve over the pericardium till they arrive toge-
ther on the upper furface of the diaphragm, and fpread
out there. This artery, fmall as it is, gives twigs as it
paffes along to almoft all the parts within the cheft.

Fourthly, The mammary gives an artery to the peri-
cardium, which may be called the UPPER PERICAR-
DIAC ARTERY; and which is of fuch importance, that
generally when it does not come off from the mammary,
it comes from the fubclavian itfelf, or even from the
aorta. It belongs to the upper and back part of the pe-
ricardium.

* Sabbatier is fo confufed, and copies Haller fo ill, that he mif-
takes this for the tranfverfalis humeri, which is really an important
artery.

Fifthly,

Fifthly, The pericardium has another artery from the mammary, which belongs to that part of the heart which is united to the diaphragm : it is thence named by fome ARTERIA PHRENICO-PERICARDIACA.

Sixthly, The mammary gives many fmall arteries to the mediaftinum ; for the mammary is covered only by the fterno-coftalis mufcle, which is often hardly vifible in Man, fo that the artery may be faid to lie upon the pleura, betwixt it and the ribs. The mediaftinum is juft that doubling of the pleura which defcends from the fternum to the fpine, and of courfe many fmall arteries go down from the lower furface of the fternum along the pleura into the mediaftinum, and by that to the pericardium, or even to the membrane of the lungs.

The mammary, as it goes downwards, fends branches through the interftices of the ribs ; two twigs pafs through each interftice, going to the intercoftal mufcles, and to the mufcles which lie upon the thorax, as the pectoral mufcles; alfo to the mamma, to the obliquus externus abdominis, they form loops of inofculations round the ribs with the proper intercoftal and thoracic arteries. Thefe twigs pafs through the interftices of the fix or feven upper ribs, but at the feventh the artery itfelf comes out. They are too numerous and too fmall to be either counted or named.

Seventh, The mammary, before it terminates in the two branches, of which one keeps the middle and goes to the rectus mufcle, while the other goes outwards to the oblique mufcle, as already defcribed, gives about the place of the fixth rib a branch which, in place of paffing out of the thorax, keeps to its inner furface, goes downwards along the feventh, eighth, and ninth ribs, makes its inofculations there with the intercoftal and other arteries, and ends in the fide of the diaphragm, and in the tranfverfe or innermoft mufcle of the abdomen, which indigitates, as we call it, with the diaphragm. From this deftination it is fometimes named the RAMUS MUSCULO-PHRENICUS.

2. ARTERIA

2. ARTERIA THYROIDEA INFERIOR.

THE LOWER THYROID ARTERY, whofe branches go
to the neck, the fhoulder, and the thyroid gland, arifes
from the fore part of the fubclavian artery, clofe upon
the origin of the internal mammary.   It is there covered
by the root of the maftoid mufcle.   It buds out from
the root of the great axillary artery, in the form of a
fhort thick ftump, which immediately divides whip-like
into four fmall and flender arteries.

1. The main branch of this artery is again named the
ramus thyroideus arteriæ thyroideæ.   This thyroid artery
is the firft great branch; it does not afcend directly, but
moves a little inwards towards the trachea, from which
the root is a good deal removed; it bends behind the ca-
rotid artery, is tortuous, afcends by the fide of the
trachea till it touches the lower lobe of the thyroid gland;
it fpreads upon it like a hand, inofculates very freely with
the upper thyroid artery, and nourifhes the gland. This
branch moreover gives fome twigs upwards to the lower
conftrictors of the pharynx and to the œfophagus; but
its chief arteries, befide thofe which plunge into the
gland, are its TRACHEAL ARTERIES.   Thefe tracheal
arteries, two or three in number, are reflected along the
trachea, turn down with it into the cheft, and reach even
to the bifurcation of the trachea, where, inofculating
with the intercoftal arteries, they form a moft beautiful
net-work.

2. The afcending thyroid artery, or *thyroidea afcen-
dens*, is a fmall and delicate branch, which lies pretty
deep, going off rather from the back part of the artery;
it fupplies all the deep parts of the neck, and even pene-
trates the vertebræ; it foon divides into an irregular
number of branches; the artery keeps almoft clofe to
the naked vertebræ, lying under moft of the mufcles;
its general tendency is upwards, furrounding the neck
in a fpiral form.   Its chief twigs are, firft, fome which
go towards the furface, *i. e.* to the mufcles which lie
over

over the artery, as to the fcalenus, the maftoid mufcle, the levator fcapulæ, and the fplenius; and twigs of this artery play over the rectus capitis and the anterior fur-face of the vertebræ, and attach themfelves to the eighth pair of nerves, and to the ganglion of the fympathetic nerve. Its deeper arteries again go to the inter-tranfver-farii and other mufcles which lie clófer upon the neck; and thefe are the branches which pafs in through the in-tervertebral holes, and penetrating the fheath of the fpinal marrow, and following its nerves, inofculate with the fpinal arteries.

3. The tranfverfe artery of the neck, or tranfverfalis colli, is an artery of the fame kind with the laft, viz. chiefly deftined for the mufcles, but more fuperficial. It paffes obliquely round the neck outwards and upwards, goes under the trapezius mufcle, and covered by it fends branches as far as the occiput. Its twigs are diftributed thus: Firft to the maftoid mufcle and to the fkin; next to the trapezius, levator fcapulæ, and fplenius; then a long branch paffing obliquely upwards over the fplenius, and under cover of the trapezius, gives twigs to thofe mufcles, and ends in inofculations with the lower branches of the occipital artery; and laftly, another branch goes downwards towards the fcapula and fhoulder.

4. The laft branch of this artery is the TRANSVER-SALIS HUMERI; an artery fo important in its deftination, and fo irregular in its origin, and fo frequently arifing as a diftinct and particular branch, and having fo little relation to thefe trivial branches of the thyroid artery, that I fhall defcribe it by itfelf.

3. ARTERIA VERTEBRALIS.

THE vertebral artery arifes next from the upper part of the fubclavian artery; and running upwards and backwards but a little way, it plunges into the hole de-ftined for it in the vertebræ; and it has been already de-fcribed through all its courfe both within the bony canal and within the brain.

4. ARTERIA

4. ARTERIA CERVICALIS PROFUNDA.

THE deep cervical artery comes next in order; it is generally the leaſt important of all the branches from the ſubclavian artery, and the leaſt regular in its place. It often comes from ſome other branch, and often it is entirely wanting: its courſe reſembles a good deal that of the tranſverſalis colli, *i. e.* it goes to the deepeſt muſcles of the neck, and to the vertebræ, and ends about the occiput; it uſually ariſes from that part of the ſubclavian artery where it is juſt going to paſs, or has already paſſed, betwixt the ſcaleni muſcles. Its branches are few in number, it gives branches to all the ſcaleni muſcles; others alſo which play over the anterior ſurface of the vertebræ and the deep muſcles of the neck, as the ſpinalis colli, inter-tranſverſarii, the root of the ſplenius and trachelo-maſtoideus; the complexus alſo receives a branch, which uſually inoſculates with the occipital artery.

5. ARTERIA CERVICALIS SUPERFICIALIS.

THE SUPERFICIAL CERVICAL ARTERY is ſtill leſs regular, being very often ſupplied by the thyroid. Its courſe is directly the reverſe of the laſt, running rather outwards and downwards, or, in other words, belonging rather to the ſhoulder than to the neck. The ſubclavian artery has got from under the muſcles, and has paſſed the ſplenii a little way before it gives off this ſuperficial cervical. This artery immediately attaches itſelf to the plexus of the brachial nerve, and is indeed hidden in the plexus: its firſt branch is given to the plexus, but its next and chief branch goes acroſs to the top of the ſhoulder; it ſends branches to the levator ſcapulæ, trapezius, and even to the ſkin; while a deeper branch goes to the ſplenius and complexus, where theſe muſcles ariſe in the neck; and when this artery is large, it ſends branches along the margin of the ſcapula, which go

go even to the ferratus major, rhomboides, latiffimus dorfi, &c.

AFTER enumerating thefe jarring names, I perceive the neceffity of arranging once more thofe arteries which go to the neck. Let the ftudent then obferve, 1. That the vertebral artery goes to the brain, that the cervical arteries belong to the mufcles of the neck. 2. That the thyroid gives two arteries to the neck, the thyroidea afcendens and the tranfverfalis colli. 3. That when a fecond fet of arteries for the neck begins to be enumerated, the name is changed; that of colli is dropped, and that of cervicis adopted. 4. That as there are two branches of the thyroid going to the neck, viz. the afcending thyroid and the tranfverfalis colli, there are alfo two entire arteries going to the neck, and which come off immediately after the thyroid, viz. the cervicalis profunda more conftant, and the cervicalis fuperficialis which is lefs regular.

6. ARTERIA INTERCOSTALIS SUPERIOR.

THE UPPER INTERCOSTAL is given to fupply the intercoftal fpace betwixt the two uppermoft ribs, becaufe the aorta which gives out all the other intercoftals, regularly one for each rib, does not begin to give them off till after it has made its turn downwards; of courfe it leaves the two upper ribs without arteries. To fupply this, then, is the office of the fuperior intercoftal artery, which is about the fize of a crow-quill, and goes off from the fubclavian generally next after the vertebral and thyroid arteries. It comes from the upper and back furface of the fubclavian trunk; it turns downwards and backwards, and lodges itfelf by the fide of the fpine in the hollow where the fpine and the firft rib are joined, and where the firft thoracic ganglion of the great intercoftal nerve lies. Before it takes its place betwixt the ribs, as the intercoftal of the two upper fpaces, it fends a branch upwards upon the face of the lower vertebræ of the neck, which is given to the fcaleni, to the lon-

gus

gus colli mufcle, and to the nerves : next it gives off the higheft intercoftal artery for the fpace betwixt the firft and fecond ribs, which artery divides into two branches ; one perforates the thorax, and goes out upon the back, and fupplies the mufcles which lie flat upon the back of the cheft ; while another branch, the proper intercoftal branch, runs along betwixt the ribs.

Next it gives off a fecond intercoftal artery, which alfo has its external and internal branches, and of which a branch inofculates over the third rib with the uppermoft intercoftal of the aorta. Befides thefe, it gives alfo fmall branches to the œfophagus, which inofculate with the tracheal arteries ; and it gives branches to the fpinal marrow, which pafs into the canal along the holes for the nerves ; and which not only fupply the fheath, but alfo inofculate with the arteries of the fpinal marrow itfelf.

7. ARTERIA SUPRA-SCAPULARIS.

THE SUPRA-SCAPULAR ARTERY, or the fuperior fcapular artery, is one of fuch magnitude, and is fo different in fize and deftination from the cervical and other fmall arteries of the neck, that it ought to be defcribed apart ; though of great fize and importance, it is yet fo little known, that Sabbatier does not even defcribe nor name it.

The SUPRA-SCAPULAR ARTERY very often comes off from the THYROID artery ; in which cafe it is the laft in order of all the branches of the thyroid, that is to fay, the neareft to the fhoulder, and then it is named TRANSVERSALIS HUMERI, becaufe of its going acrofs the root of the neck to the fhoulder. Sometimes it arifes from the cervicalis fuperficialis ; but then it is a fmall artery, and I fufpect it reaches in fuch cafes no further than the tip of the fhoulder, and does not defcend to the fcapula. Often I fee it arifing as a diftinct artery, large, very long, tortuous like the fplenic artery, and almoft equalling it in fize ; running acrofs the root of the neck, till at the top of the fhoulder it
dives

dives under the acromion procefs; and then paffing through the notch of the fcapula, fupplies all the flefh of its upper furface.

. The reafon of my naming it fupra-fcapular artery, is its paffing thus over the fcapula, while another, the largeft branch of all thofe proceeding from the axillary artery, is named fub-fcapularis, from paffing under the fcapula.

To repeat the origin then of this fupra-fcapular artery, it arifes fometimes as an independent artery, and is fo great, that we wonder that it does not always do fo: often it arifes from the thyroid, is its laft branch, and is named TRANSVERSALIS HUMERI, authors not obferving that it belongs abfolutely to the fcapula; it rarely arifes from the cervicalis fuperficialis; and when it does fo, it is fmall: often in a ftrong man it arifes apart; and when it does arife from the thyroid or cervical arteries, it is fo large as to annihilate as it were all the other branches of the artery from which it arifes.

Where this artery paffes out of the cheft it is covered only by the root of the maftoid mufcle; and it gives twigs to the maftoid, to the mufcles which afcend to the throat, to the fubclavian mufcle, to the fat, jugular vein, and fkin.

Next it gives a fuperficial branch to the fkin, trapezius, and other fuperficial parts about the fhoulder.

Next it turns over the acromion procefs, paffes through the fupra-fcapular notch, with many windings and contortions; fpreads itfelf over all the outer furface of the fcapula, both above and below the fpine, and is the fole fupra-fcapular artery. The manner of its fpreading is this; having paffed through its hole in company with the fupra-fcapular nerve, the inftant that it has paffed the hole and begins to lie flat upon the fcapula, it fends off two branches, one on either hand at right angles; and of thefe one goes along the upper border of the fcapula towards its bafis, the other goes in the other direction towards the fhoulder-joint, and circles round the upper fide of the fpine or ridge of the fcapula.

The main artery having firft perforated the fcapular
notch,

notch, and given thefe two fmall branches, next makes
a fecond perforation, viz. by paffing under the root of
the acromion procefs; and then it again divides into
large branches in which it ends. The one branch runs
all along the root or bafe of the fpine or high ridge; the
other branch runs nearly in the fame direction, but lower
down, viz. nearer that edge where the great fub-fcapular
artery runs; and with which, of courfe, it makes many
free inofculations.

This artery lies fo acrofs the neck that it may be cut,
efpecially in wounds with the fabre; and in a big man
it is of fuch fize as to pour out a great quantity of
blood. It is neceffary for the furgeon to remember the
great fize of this fupra-fcapular artery, its long courfe
over the fhoulder, at what place it arifes within the cheft,
and how it may be compreffed. But in another fenfe
alfo it is peculiarly important; for the fupra-fcapular ar-
tery makes inofculation with the lower fcapular artery,
freer, and fuller, than in almoft any other part of any
limb. One can hardly force tepid water through thofe
fmall arteries which fupport the arm after the operation
for aneurifm; but the inofculations of this fupra-fcapu-
lar artery are fo free, that often, though I have tied the
arteries with great care, the very coarfeft injection has
gone round by it; and when I defired only to inject the
head, I have found the arteries of the arm entirely filled.
The conclufion which this leads to in wounds of the axil-
lary artery is too obvious to need any further expla-
nation.

II. OF THE AXILLARY ARTERY.

THIS artery affumes the name of axillary, where it
lies in the arm-pit or axilla. The fcaleni mufcles being
attached to the ribs, the artery paffes firft through be-
twixt the firft and fecond fcalenus; next it paffes out
from under the arch of the clavicle, where it was pro-
tected:

tected ; then it falls over the breaft in a very oblique di
rection ; it inclines outwards towards the axilla, lies flat
upon the flanting convexity of the cheft, is covered by
the pectoral mufcles, becaufe the pectoral mufcles arife
from the clavicle, under which the artery paffes ; but far
from being protected, it is fo far expofed as to be eafily
felt beating, and it is at this point only that it can be
rightly compreffed.   It declines ftill outwards and down-
wards, till at laft it gets fo deep into the arm-pit, and fo
much under the fcapula, as to lie betwixt the ferratus
anticus and fub-fcapular mufcles.   There it is rightly
called the axillary artery.   In this hollow it lies fafe,
protected by the deep borders of the pectoral mufcle be-
fore, and of the latiffimus dorfi behind, furrounded
with fat and glands, inclofed within the mefhes of the
plexus, or great conjunction of nerves, which go to the
arm, furrounded alfo by all the veins of the arm, which
twine round it in a wonderful manner.   Here it gives
off the thoracic arteries to the thorax, and the fcapular
arteries to the fhoulder.   In fhort, the axilla itfelf is a
complicated ftudy ; but in all that refpects the arteries it
may be made very eafy and plain.   But let the furgeon
remember that it is only by a perfect knowledge of the
arteries, a bold ftroke of the knife, and a mafterly ufe
of the needle, that the patient is to be faved from bleed-
ings after wounds hereabouts ! for the old ftory of com-
preffing the axillary artery above the clavicle is now of
no credit with any furgeon of knowledge or good fenfe.
    As the artery turns over the borders of the cheft, it
gives one or two twigs to the adjacent parts, as to the
fcaleni, and to the great nerves which lie over the artery,
and to the ferrated mufcle, where it lies under the fca-
pula : but thefe branches are fo fmall that it is unnecef-
fary either to number or defcribe them.   The thoracic
or external mammary arteries are the firft important
branches ; they are four in number, and they are named
after their place or office.

                                     1. ARTERIA

1. ARTERIA THORACICA SUPERIOR.

THE UPPER THORACIC ARTERY, being the firſt, lies of courſe deep in the axilla. It comes off about the place of the firſt or ſecond rib; it lies betwixt the leſſer pectoral and the great ſerrated muſcles; it gives its chief branches to theſe muſcles, and it alſo gives other branches to the intercoſtal muſcles and the ſpaces betwixt the ribs. But, upon the whole, it lies very deep, is ſmall, is ſo ſhort that the next is entitled thoracica longior; it is an artery of little note.

2. ARTERIA THORACICA LONGIOR.

THE LONG THORACIC ARTERY is more important, ſupplying all the great pectoral muſcles and the mamma. It was named the external mammary artery; but we are the more willing to change the name, ſince it has no likeneſs to the internal mammary artery; is in no reſpect a counter-part to it; it might be named the pectoral artery. It is long, not tortuous, but ſtraight and ſlender, and about the ſize of a crow-quill. It is needleſs to deſcribe an artery ſo variable in its branches as this is; it is ſufficient to ſay, that after giving ſmall twigs to the axillary glands, it terminates with all its larger branches in the pectoral muſcle, mamma, and ſkin, and in inoſculations with the intercoſtals and internal mammary; it is very long, deſcending ſometimes ſo low as to give branches to the oblique muſcles of the belly.

3. ARTERIA THORACICA HUMERARIA.

THE THORACIC ARTERY of the ſhoulder goes off from the upper and fore part of the axillary artery. Its place is exactly oppoſite to that of the mammaria ſuperior, viz. under the point of the coracoid proceſs, infomuch that Haller has named it thoracica acromialis. It is a ſhort, thick artery; it burſts through the interſtice between the pectoral and deltoid muſcles, and appears

4   upon

upon the fhoulder almoft as foon as it comes off from the main artery; it refembles the thyroid in fhape, being a fhort thick artery, terminating all at once in a lafh of flender branches, which go over the fhoulder in various directions; but I never could obferve any order worth defcribing. One deeper branch goes to the ferratus major, a branch goes along the clavicle, gives it the nutritious artery, and then goes on to the pectoral mufcle, and to the fkin of the breaft: it gives fmall branches to the axillary glands, and larger ones to the deltoid and pectoral mufcles and fkin of the fhoulder, for this is very much a cutaneous artery. The chief branch is that which is laft named, running down betwixt the deltoid and pectoral mufcles; and the moft curious branch is a fmall artery which accompanies the cephalic vein, and runs backwards along the courfe of the vein, a fmall and beautiful branch.

4. ARTERIA THORACICA ALARIS.

SOMETIMES, though not always, there is a fourth thoracic artery. When it exifts, we find it clofe by the laft artery; its branches, which are fometimes numerous, belong entirely to the cup or hollow of the axilla; it goes to the glands and fat, and thence its name of ALARIS or AXILLARIS. This is the deepeft or backmoft of thefe mammary arteries; it attaches itfelf to the lower border of the fcapula, and we often fee it running along the lower border a confiderable length, and giving branches chiefly to the fub-fcapularis mufcle.

THESE are the four mammary arteries which go to the breaft. The arteries which go to the fcapula follow next, and are only three in number; one, which is the counterpart of the fupra-fcapular artery, is the greateft branch from the axillary artery, fupplies the lower furface of the fcapula, and thence is named SUBSCAPULAR ARTERY;

ARTERY; one, which, as it is reflected round the joint
by the outfide, is named the EXTERNAL CIRCUMFLEX
ARTERY; and one, which, as it turns round the inner
fide of the joint, is named the INTERNAL CIRCUMFLEX
ARTERY.

5. ARTERIA SUB-SCAPULARIS.

THE SUB-SCAPULAR ARTERY is of a great fize; it
is hardly defcribed in books, I might fay is hardly
known to anatomifts. Douglas, and moft efpecially
Sabbatier, have fcarcely named it, though it is in fact
one of the largeft arteries in the body, being abfolutely
as large as the axillary artery, from which it takes its
rife *.

The greateft mafs of flefh in almoft any part of the
body is that which lies under and around the fcapula in
a ftrong man; and this artery fupplies almoft all that
mafs.   It goes off from the axillary oppofite to the neck
of the fcapula, juft under the long head of the biceps
brachii: it no fooner comes off from the axillary artery,
than it attaches itfelf to the lower border of the fcapula;
and as foon as it comes to the edge of the fcapula (but
fometimes lower down the edge, viz. where the head of
the biceps comes off) it fplits into two great branches;
one of which goes to the upper, and one to the lower
furface.   But to defcribe each little artery among fuch a
mafs of flefh, or to expect to find them regular, would
be very thoughtlefs; the general courfe of them only
can be defcribed.   Firft, The greater branch, which
goes to the lower furface of the fcapula, is the proper
trunk of the fub-fcapular artery; it divides into two
great branches, which courfe all over the lower or hol-
low furface of the fcapula: one of thefe is deeper, runs
downwards along the naked border of the fcapula, lies

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* It is named often fcapularis inferior or infra-fcapularis; it is
better named fub-fcapular, both to harmonize with the name fub-
fcapular mufcle, to which it belongs, and alfo to contraft with its
counterpart, the fupra-fcapular artery, which comes from the fub-
clavian artery.

under

under the muscles upon the flat bone, and supplies the inner surface of the subscapular muscle with many branches. It sends a branch upwards, which runs along the inner surface of the neck of the scapula, runs still forwards under the root of the coracoid process, and its extreme branch goes round by the basis of the scapula to make an inosculation with the larger branch.

Secondly, The larger branch keeps nearer the surface, and supplies all the outer side of the sub-scapular muscle. Its general course is round the scapula, down the fore-edge, then round by the lower angle, then up by the line of the basis scapulæ, encircling it with what might be named a coronary artery. It first gives branches to the teres major; then passes down along that muscle to the angle of the scapula; then turning along the angle of the scapula (which it does not do without leaving many branches behind), it runs in a waving line all round the basis scapulæ, till it arrives at the upper corner, where it ends in free inosculations, both with its own deeper branch, and also with the supra-scapular artery which comes along the shoulder.

Now this great branch, with all its arteries, belongs entirely to the lower surface of the scapula; but the branch which leaves it at the neck of the scapula turns round under its lower edge, gets to the upper surface of the scapula, runs in under the infra-spinatus and teres major muscles, betwixt them and the bone; and although the supra-scapular artery from the shoulder supplies chiefly the upper part of the scapula, yet it is chiefly above the spine that that artery circulates, while the lower parts of the infra-spinatus and the teres minor muscles are left to be supplied by this reflected branch of the sub-scapular artery: thus this reflected branch gives its arteries, first to the teres, then it enters into the hollow under the spine, and besides supplying the infra-spinatus and the bone itself, it also makes a circle, though a shorter one, and inosculates with the supra-scapularis, just as the other branch of this same artery does on its lower surface. This branch descends nearly to the corner of the scapula before it begins this inoscu-

lating

lating circle; but it fends alfo another chief branch round the neck of the fcapula, which advancing towards the fupra-fcapular notch, inofculates very largely with the fupra-fcapular artery.

Thus is the fcapula encircled, and fupplied with a wonderful profufion of blood by two great arteries; one, the SUPRA-SCAPULAR ARTERY, coming acrofs the neck, over the fhoulder, and through the fcapular notch; another, the SUB-SCAPULAR ARTERY, which comes from the axilla to the lower flat furface of the fcapula, and divides at the edge of the fcapula into two great branches; one of which keeps ftill to the flat furface, while the other turns over the edge of the fcapula, and fupplies in part its upper or outer furface.

6. ARTERIA CIRCUMFLEXA POSTERIOR.

THE POSTERIOR CIRCUMFLEX ARTERY is a very large one. It arifes either along with, or immediately after, the great fub-fcapular artery; the place of it is of courfe fettled by the place of the fhoulder-joint, for it belongs fo peculiarly to it that it is fometimes named the Humeralis, fometimes the Articularis, fometimes the Reflexa Humeri. It goes off between the fub-fcapularis and teres major mufcles; it paffes in between them to get to the joint; it then turns round the fhoulder-bone, accompanied by the circumflex nerves, juft as the fupra-fcapular artery is accompanied by the fupra-fca-pular nerve; it ends, after having made nearly a perfect circle, upon the inner furface of the deltoid mufcle.

Its branches are, firft, Twigs to the nerve which accompanies it, and to the capfule of the fhoulder-joint.—Secondly, Branches to the coraco-brachialis and fhort head of the biceps, and to the triceps, and a twig to that groove in which the tendon of the long head of the biceps lies.—Thirdly, It fends large branches to the fub-fcapularis, to the long head of the triceps, &c.—And, laftly, The artery, far from being exhaufted by thefe branches, goes round the bone, turns over the joint under the deltoid mufcle, and ends in a great num-

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ber

ber of branches, still accompanied by branches of the nerve, which are distributed in part to the capsule, but chiefly to the lower surface of the deltoid muscle, where it lies upon the joint.

7. ARTERIA CIRCUMFLEXA ANTERIOR.

THE ANTERIOR CIRCUMFLEX ARTERY, which goes round the fore part of the joint, bears no kind of proportion to that great artery which passes round the back. The anterior goes' off from the same point nearly with the posterior, or sometimes arises from the posterior itself; it takes a direction exactly opposite; it keeps close to the shoulder-bone, passes under the heads of the coraco-brachialis and biceps; encircles the head of the os humeri just at the root of the capsular ligament, and goes round till it meets and inosculates with the posterior circumflex artery. I never could find those muscular branches which are said to go to the scapula, or have found them very trivial; the whole artery belongs to the bone and its parts; it encircles the root of the capsule with a sort of coronary artery; it gives twigs to the capsule, the periosteum, and the tendons, which are implanted into the head of the bone; and having given twigs to the heads of the biceps and coraco-brachialis, it gives off its only remarkable branch, which is indeed regular and curious; it is a small branch which runs down along the bone in the groove in which the tendon of the biceps lies.

CONCERNING the axillary artery in general, there is more to be observed than this occasion will allow. But these things must not be passed over in total silence. In the first place, the artery, as it passes over the border of the chest, and after leaving the arch of the clavicle, is felt beating, and there it can be compressed.

The compressing of the subclavian artery with a tourniquet or with the thumb, attracted at one time so

much

much attention, and incited so many to speak about it, that it came to be thought important, and has been ever since esteemed practicable; and yet even those who have spoken the most confidently have taken the thing merely upon vague report, have neglected to read the proper books, have described the way of compressing as above the clavicle, not knowing that it should be done below it. Camper, in his " Fabrica Brachii Humani," first mentioned what he had demonstrated in his class, viz. that he could, by placing the thumb under the point of the coracoid process, so compress the axillary artery against the second rib where it lies upon it, that even the strength of a syringe could not push an injection through it *. And those who learn things by hearsay, have said that " the subclavian artery could be compressed by thrusting the thumb in above the clavicle;" although in fact, the arch is so deep, the muscles so strong, and the artery so little exposed, that this is absolutely impossible.

From my speaking with a seeming interest about the preference of one of these two places to the other, it may be thought that I believe this piece of knowledge useful: Quite the reverse! I know it to be dangerous; I know it to be less practicable than authors report and believe; and I repeat what I said on a former occasion, that " it is easy to stop the pulse of an artery, but quite another matter to stop the flow of blood through it." We thrust down our hands and compresses, and rest with our whole weight upon the artery; it seems

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* In cadaveribus plus semel in publico theatro monstravi, comprimi posse integram arteriam; ligabam arteriam aortam infra arcum, resecabam deinde axillarem dextram, ac siphone axillari sinistræ adaptata fortiter aquam impellens, solo digito eo modo moderare potui subclaviam, ut ne gutta quidem efflueret: quod quanti momenti esse queat in amputatione humeri in articulo nemo non videt. In vulneribus sclopetariis, aliisque circa humeri articulum inflictis, sanguinis profusionem similiter compescere, si non penitus sistere possemus. Vid. *Camper*, lib. i. p. 15.—The plain reason why we are able thus to compress the artery in the dead subject is the want of resistance in all the muscles. If ever it be possible in the living body, it must be when the strength is low, and the circulation very languid, after the patient has fainted with loss of blood.

stopped,

ftopped, becaufe the pulfe is ftopped; but the firft
ftroke of the knife fhows us how far we are gone in a
dangerous miftake. I may fay, without breach of con-
fidence, that I have feen one gentleman truft to it, who
will never trouble himfelf about it again. He was a
dexterous furgeon; and in a great aneurifm of the axilla
was deluged with blood at the firft ftroke of the knife,
and faved his patient only by a plunge of the great
needle.

Secondly, It is much to be lamented that we cannot
really fupprefs the blood; not merely becaufe it would
make every wound lefs dangerous, but becaufe it would
greatly facilitate operations which we are called upon
every day to perform. Would it not be pleafant if we
could cut the cancerous breaft without the lofs of blood?
or fearch into the axilla with perfect deliberation, and
cut difeafed parts out with the knife, not tearing them
in a brutal manner with our fingers? Yet ftill, by
ftudying this piece of anatomy, the furgeon knows both
from what fource all the arteries which bleed upon the
furface of the amputated breaft come, viz. the long
mammary artery; and alfo that in any very dangerous
fituation it would be eafy to command all the bleeding
orifices by one dip of the needle, the axilla being open.
He alfo knows that the thoracica alaris and the fhort
thoracic artery fupply all the glands, and that thefe
lurk too deep in the axilla to be fecured otherwife than
by a comprefs: fo that thefe arteries are in fact opened
by tearing with the fingers, and are ftopped by thrufting
in a fpunge. He knows alfo how many large arteries
there are, efpecially about the fcapula, of which the
bleeding muft refemble that of the axillary artery itfelf;
he will judge of the nature of the wound by the pulfe;
and he will act with great advantage in all doubtful
cafes, by remembering thefe great arteries of the fcapula,
which either bleed outwardly moft furioufly, or if they
feem to ftop, it is only by filling the axilla with blood.

Thirdly, The connection of the artery with the axil-
lary nerves, though it muft be more fully defcribed in
another place, muft yet be obferved here as a relation

N 3

too

too important to be omitted. The artery paſſes along with the nerves through the interſtice of the ſcaleni muſcles; the nerves, which conſiſt of no leſs than ſeven pairs, make by their mutual connections a ſort of net, which is called the plexus of the axillary nerves. This plexus has its meſhes formed, not by ſmall diviſions, but chiefly by the ſeven great cords. This broad plexus lies over the artery as it comes out from the cheſt; the artery perforates the plexus, or paſſes through one of the largeſt meſhes in the cavity of the axilla; and when we extend the arm, for example, to cut out an axillary gland, the great veins lie neareſt the knife, or loweſt in the axilla; the plexus of nerves next; and laſt of all the artery which has juſt perforated the plexus of theſe great nervous cords; three nerves are below the artery and two above; and when the arm is luxated, and the ſhoulder-bone puſhed downwards, the head of it is ſo preſſed againſt the net of nerves, and the artery is ſo compreſſed betwixt the head of the bone and the meſh of nerves, that I have very ſeldom failed to find the pulſe almoſt entirely ſuppreſſed in luxations of this kind.

This connection, viz. with the nerves, is a very intereſting one. It is plainly ſuch that the artery cannot be hurt without a wound of the nerves; it has never been known that the artery has been cut in the axilla without the arm being lamed by this wound of the nerves: alſo the nerves cannot be hurt without the artery being in danger; but it does eſcape ſometimes; of which, among other examples, this is one of the moſt ſingular.—I have ſeen the artery eſcape in wounds when the nerves were hurt; but how it could eſcape the ſtroke of a blockhead's needle in the following caſe, I am at a loſs to conceive. A woman came to me with a great ſtring hanging in her axilla, and along with her came her ſurgeon. He had about three months before cut off her breaſt for a cancer, and moreover ſome glands from the axilla, from which there was a bleeding; and of courſe, as his fingers could not go deep enough, he took a needle proportionably large, ſtruck

it,

it down into the arm-pit, and tied all up. When he brought his patient to me, there hung from the arm-pit, not a furgical ligature, but a good large tape; the axilla was a large gaping and terribly fetid ulcer; I paffed my finger into it, and felt the arteries beating around it, and the tape firm about fome cord of nerves, whether one or more I could not tell; the Woman's fingers were as crooked as a bird's talon, and her arm hung by her fide quite ufelefs and lame. I made the furgeon feel the nerve-with his finger, and offered to cut out the ligature fafely; but he carried away his patient, that he might, though at a long interval, finifh the operation himfelf.

The breaft had been long healed, and the cord acted as an iffue in the axilla. How near the edges of this needle muft have been to the great artery, it is terrible to think; and it is moft providential that fuch accidents do not happen daily, confidering how much this crooked needle is ufed in deep places, where it is leaft fit to be ufed.

III. OF THE BRACHIAL ARTERY.

The brachial artery is that divifion of the artery which is marked by the tendon of the great pectoral mufcle: for as that is the fore border of the axilla, all above that is axillary, and all below it brachial artery, down to the bend of the arm, where it divides into the radial and ulnar arteries. The brachial artery runs on the inner fide of the os humeri, here the bone is moft naked; and this is the line in which we feel the artery beating, and apply the cufhion of the tourniquet.

To defcribe, as fome authors have done, each infignificant and namelefs branch which this artery gives off, were to make a fimple matter intricate beyond all enduring. The whole matter is this: As the artery goes downwards, lying exactly on the inner fide of the arm bone, and directly in the middle betwixt the biceps on the fore part and the triceps behind, it gives frequent branches to each. Thofe going to the biceps are fhort,

N 4   fmall,

fmall, pretty regular, and exceedingly like each other all the way down the arm ; and they are thus frequent, and very fhort, in confequence of the artery adhering clofer to the fides of the biceps. Not one of them can be diftinguifhed, or is worth naming. Thofe which it fends downwards to the triceps are (in confequence of that being a large mufcle, with feveral thick and flefhy origins) both longer and more tortuous, and more impor- tant ; and they accordingly have fome of them appro- priated names. Of thefe arteries going down towards the back part of the arm, and working their way among the mufcles, three chiefly are to be obferved. Firft, The arteria profunda fuperior; which goes round the back of the arm to the exterior mufcles, and is often named the upper mufcular artery. Secondly, Another like it, called arteria profunda inferior, or the lower mufcular artery. Thirdly, The ramus anaftomoticus major, which anaftomofes round the elbow with the branches of the ulnar artery. Thefe three chiefly de- ferve notice.

I. ARTERIA PROFUNDA HUMERI SUPERIOR.

THOSE arteries, which in the limbs go deep among the flefhy parts, as in the arm or thigh, have always one of two names, either profunda or mufcularis, and often both. The upper deep mufcular artery of the arm is about the fize of a crow-quill, or larger ; it goes off from the inner fide of the brachial artery, juft where the tendons of the latiffimus dorfi and teres are inferted ; and very often it arifes from the great artery of the fca- pula, or that of the joint, viz; the fub-fcapularis, or re- flexa humeri.

The PROFUNDA turns downwards and backwards round the bone ; it glides in betwixt the firft and fecond head of the triceps ; there it divides within the thick flefh of that mufcle into two chief branches, or the two branches fometimes part immediately after their common origin, or fometimes they go off apart from the humeral artery. One of thefe, perforating the biceps mufcle,

turns

turns quite round the bone; and Monro the Father, who gave us the name of fpiral nerve, named this alfo, very properly, the mufcular fpiral artery: fo this artery alfo, as well as the fupra-fcapular and circumflex arteries, has its accompanying nerve. This long artery runs down the back and outfide of the arm; it defcends quite to the outer condyle of the os humeri, and by branches round the olecranon, and over the outer condyle, it inofculates very freely with the radial artery.

The other branch of the profunda fuperior runs down the inner fide of the arm, gives many branches to the triceps, and coraco-brachialis; gives a few alfo to the biceps and deltoid mufcle: its longeft branch, the proper termination of the artery, runs downwards till it touches the inner condyle, as the pofterior branch does the outer condyle; and this inner artery communicates with the outer branch round the olecranon, making fmall but frequent and beautiful inofculations; and it alfo inofculates over the condyle with the reflected branch of the ulnar artery. In fhort, the profunda fuperior turns down towards the back part of the arm, buries itfelf under the triceps mufcle, fupplies all the flefh of the triceps, and divides in the heart of that mufcle into two branches, both of which go down to the elbow-joint, and inofculate; the one, round the outer condyle with the radial artery; the other, round the inner condyle with the ulnar artery.

2. ARTERIA PROFUNDA HUMERI INFERIOR VEL MINOR.

THE LESSER PROFUNDA, or the lower mufcular artery, is fo named becaufe it refembles the former in almoft all points. It is fmaller, being not half the fize (viz. of a crow-quill), and goes off, in general, about two inches lower down the arm. Its courfe, alfo, is exactly fimilar, except in this, that it is fingle, does not divide into two branches; it gives twigs to the mufcles of the arm; runs down to the inner condyle, and

after

after touching it, makes a fudden and ferpentine turn, by which it gets upon the back part of the elbow-joint. Its chief inofculations are with the upper profunda, and with the recurrens interoffea upon the back part of the joint.

Betwixt the upper and lower profunda there generally is fent off that artery which is to nourifh the bone. It is named ARTERIA NUTRITIA HUMERI; but is not of fufficient importance to be numbered among the main branches of the artery. The nutritious artery fends off fmall branches, or rather fmall twigs, to the brachialis, or that mufcle which lies under the biceps and to the triceps; and it perforates the bone about its middle in one larger artery, and fometimes there are alfo one or two fmaller ones.

3. RAMUS ANASTOMOTICUS MAJOR.

THE GREATER ANASTOMOSING ARTERY is one of three or four which anaftomofe round the elbow-joint: for as the humeral artery advances towards the bend of the arm, it begins about three inches above it, to give off fidewife, and almoft at right angles with the trunk, three or four fmall arteries, more or fewer according to the fize of the arm. Each of thefe fends its little twigs round the condyle, to inofculate with the arteries of the fore-arm both radial and ulnar. Among thefe one is diftinguifhed for its fize and importance; it is one of the largeft of thefe arteries, and thence named ANASTOMOTICUS MAGNUS; it arifes from the Humeral artery about three inches above the joint; it lies clofe by the fide of the brachialis internus, and gives many branches to it and to the triceps; but it is chiefly expended in three branches, one of which turns backwards, and running up the arm gives branches to the mufcles, and inofculates with the profunda: another goes downwards towards the middle of the bend of the arm, and gives branches to the pronator teres and the flexor digitorum; and then going deeper, it touches the capfule, and makes a beautiful inofculation over the fore-part of the joint with

with the radial recurrent or inofculating artery : another branch, the moft important, and the chief termination of the artery, runs down betwixt the olecranon and the condyle, in the hollow where the ulnar nerve lies. It firft contributes to that net-work of inofculations which covers the back of the joint over the olecranon ; it inofculates very freely with the recurrens ulnaris ; and it is this inofculation that gives the artery its importance and its name. This is the channel through which the blood goes after the operation for the aneurifm, as we know from preparations ; and I have feveral times felt for it, and found it after the operation, while the arm was ftill very fmall, having been wafted by the difeafe and by the fuppuration.

I have not, in defcribing thefe arteries of the arm, once mentioned the name of collateral artery ; for it is a name which muft be entirely dropped, becaufe it has been much abufed. Sabbatier, Murray, Haller, and all the French and German anatomifts, have named the arteriæ profundæ COLLATERAL ARTERIES; becaufe they lie alongfide of the great artery, running along with it down the arm. Douglas, and the Englifh anatomifts and furgeons, have called the three or four fhort anaftomofing branches near the elbow the collateral arteries ; becaufe, though they run off at right angles or obliquely from the trunk, yet they run parallel with each other. Dropping this name, then, we find no more than three arteries in the arm of any note : the upper or greater profunda, with its two branches ; the lower or leffer profunda ; and the great anaftomofing artery.

OF THE ARTERIES OF THE FORE-ARM, VIZ. OF THE RA-
DIAL, ULNAR, AND INTEROSSEOUS ARTERY.

THE place and condition of this artery at the bend of the arm is as interefting as where it lies in the axilla ; for while bleeding is allowed, or is practifed by low and ignorant people, operations at this point muft be more

frequent

frequent than at any other, and muſt be eaſy or ſucceſs-
ful only in proportion as the artery and all its relations is
well underſtood.

The humeral artery ſtill continues an undivided trunk,
much lower than the bend of the arm ; though we are
accuſtomed to name that as the place at which it divides.
The whole arm, it muſt be remembered, is covered with a
faſcia, and that faſcia lies over the artery ; but at the
bend of the arm there is a peculiar faſcia, or at leaſt the
round tendon of the biceps ſo ſtrengthens the general
faſcia, by ſending a broad expanſion obliquely acroſs
the bend of the arm (which faſcia is fixed into the con-
dyle and down the edge of the ulna), that we call this
expanſion peculiarly the tendon of the biceps, and ſay
that the artery is at the bend of the arm covered and pro-
tected by the tendon of the biceps muſcle.   The condi-
tion then of the artery is ſhortly this : It comes from the
inſide of the arm, inclining all along towards the mid-
dle of the bend or folding of the fore-arm ; there, with-
out any particular ring or aperture for its admiſſion, it
paſſes under the aponeuroſis of the biceps muſcle ; for
the aponeuroſis of the biceps and of the arm in
general are one continued ſheath.   When thus lodged
behind the tendon, it lies in a deep hollow betwixt the
flexors and extenſors of the arm, or, in other words,
betwixt the muſcles of the upper and of the lower edge ;
the tendon of the biceps covers this triangular hollow ;
the floor or bottom of it is the coronary proceſs of the
ulna and the forepart of the elbow-joint, and there the
artery lies imbedded in cellular ſubſtance, encircled by
thoſe veins which accompany the artery particularly, and
which are thence named venæ comites ; and it carries
along with it a nerve in diameter equal to itſelf, and this
nerve is named the great radial nerve.

The artery does not divide immediately, even after it
has thus paſſed the bend of the arm, but goes down
deep among the fleſh of the fore-arm, and there divides ;
the ulnar artery being lodged under the thick fleſh of
the pronator and flexor ſublimis muſcles, and the radial
artery under the ſtrong fleſhy belly of the flexor radialis
                                                    and

and of the fupinators, not abfolutely within their fub-
ftance, but under cover of their flefhy bellies, which
fwell out into a great thicknefs at this part of the arm.
The only part of the artery which is expofed, the point
which we feel beating, is that where the fingle and undi-
vided trunk firft begins to pafs under the thicker fafcia
of the biceps mufcle; and there the artery is pufhed
forwards, raifed, and made to appear fuperficial by the
projection of the coronoid procefs and brachialis mufcle,
or, properly fpeaking, by the protrufion of the forepart
of the elbow-joint. This is juft before it finks into the
triangular hollow betwixt the mufcles.

This artery is fingular in one kind· of lufus naturæ,
which never happens, nor any thing fimilar to it, in the
lower extremity, viz. that the trunk of the artery forks
into two great branches high in the arm; fometimes in
the axilla, but oftener in the middle of the arm, or oppo-
fite to the pectoral mufcle: and I have conftantly ob-
ferved, when this happened, that the radial artery was,
as it were, the accidental branch, and paffed acrofs the
arm near the bend of the elbow, fo as to traverfe the
ulnar or main artery; and that the radial artery paffes
quite on the outfide of the fafcia, which binds down the
ulnar or main branch of the artery.

This fhort defcription involves many points which the
furgeon fhould think of, and more than can be touched
upon in this place. The following confequences cer-
tainly follow from this arrangement of parts.

Firft, The artery lying thus deep under the biceps,
cannot be hurt by any fkilful furgeon, though bleeding
the very vein under which it beats, and at the moft criti-
cal point; it is hurt, as far as I have obferved, only by
the rudeft ftroke of very ignorant fellows; I have feen
in fix cafes a wound in it little lefs than a quarter of an
inch in length. In one of the operations I found it ab-
folutely transfixed; the blood had been poured out from
the orifice behind; I felt with furprife the artery running
over the tumor, not under it; and having opened the
fac, I paffed a probe through the artery from fide to fide.

Secondly, Since the artery divides only after it has
gone

gone deep, where its great branches are protected by the mufcles of the fore-arm, the trunk only is wounded in bleeding ; the branch is never wounded ; and we cannot but be furprifed that Hunter, Haller, Sharp, and others, who ought to have ftudied this point, believed it to be fometimes at leaft wounded in one of its branches ; nor can we think, without furprife, of the arteries being fo little underftood in the time of Dr. Monro the Father, that he is forced to argue the propriety of doing the operation of aneurifm from this fact, " That though it were dangerous to truft to the common anaftomofis round the elbow, yet it fometimes happens, that the two branches of the radial and ulnar are fet off in the axilla." This furely muft have been but a cold affurance to the furgeon in thofe days, viz. that he was to truft chiefly to the chance of a lufus naturæ for the fuccefs of one of his greateft operations.

Thirdly, It muft follow, fince the artery lies behind the fafcia, and is wounded through it, that the blood, being poured out behind the fafcia, muft raife it into a hard, firm, and (in time) inelaftic tumour, growing every day firmer and harder. If furgeons will but think of this, they will go through their operation more correctly. It makes a point of vaft importance in the defcription of aneurifm, fince it gives outwardly the true character, and inwardly the true fhape and appearance of the tumour, when the operation is begun, the outward incifion being performed. Had it been but attended to rightly, what noife and wrangling might it not have faved about the nature and names of the difeafe (yet ftill the older furgeons knew and defcribed this piece of anatomy, though they made but a poor ufe of it) ? and what idle and ftupid defcriptions might it not have prevented, fuch as we have never feen in furgical books till now, of diffufed aneurifm, and the operation for diffufed aneurifm ; when in truth the firft ftroke of the knife fhows it to be a tumour very different from that which fuch names, and fuch formal divifions, and old fafhioned defcriptions muft convey ? The cup of an aneurifm is the triangular hollow which I have defcribed,

fcribed, and the bag of the tumour is the extended fafcia.

Fourthly, The courfe of this double artery tempts me to believe, that in thofe few cafes where the blood of an aneurifm was truly diffufed, where it was an ecchymofis, where the blood was not confined by the fafcia, but poured out under the fkin, and driven upwards to the fhoulder, and downwards to the fingers, giving the whole arm the appearance of mortification ; that in fuch rare cafes, there muft have been a high divifion, and that the preternatural artery had been wounded, for it lies above the fafcia, it is lodged in no hollow, fuch as might receive its blood, nor covered by any membrane which might confine it : but at all events, I am per-fuaded that Hunter is wrong in fufpecting that, fince the pulfe fo feldom returns inftantly, this preternatural artery and the true one muft be often tied together ; for if the preternatural artery were wounded, it would be a very diffufed aneurifm, under the fkin and above the fafcia ; but the main artery would be found in its place, under the fafcia, quite fafe ; whereas, if the true artery were wounded, the tumour would be under the true fafcia, the preternatural artery would crofs by the fide of the tumour, or over it, and the wounded artery being at the bottom of its own tumour, the two arteries would be fix inches apart. Befides, the neceffity of fuppofing this is not fo ftrong as Hunter believed ; I have feen the pulfe return during the dreffing of the arm, when the diffection was fo wide and free that I am fure there could be no lufus naturæ, but one artery dividing in the com-mon place.

Fifthly, The clofe connection of the artery with the great radial nerve muft always be confidered in all wounds at the bend of the arm ; and efpecially it con-ftitutes a difficulty in the operation of aneurifm, of which authors of great eminence have fpoken far too lightly ; and furgeons of character have tied it in with their great ligatures, as if for amufement, or that they might fee what would enfue. But, as I have faid on

another

another occafion, "a man muft fhow me either fome
pofitive neceffity for doing this, or fome pofitive good
confequences which will refult from it, before I admit
him to argue about the bad effects which may enfue."
Will any man perfuade me, after the cafe which I have
juft related, that it is good or harmlefs to tie in the
largeft nerve of the arm? We fee by that cafe, that the
ligature's remaining firm in its place for three months
is one of the leaft of the ill confequences, and the others
may eafily be conceived. Of thefe ill confequences I
have feen more than I will venture to tell.

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THE humeral artery having left this moft critical point
at the bending of the arm, divides into three great
branches, the radial, ulnar, and interoffeous arteries;
at leaft the ulnar gives off the interoffeous fo foon, and
the interoffeous is fo large, and has fo pointed a deftina-
tion, that I take the privilege of defcribing the three
branches apart. The ULNAR ARTERY, which we muft
regard as the continuation of the main artery, makes
its way through the thickeft flefh of the fore-arm, goes
along the ulnar edge of the arm, appears again from
under the mufcle, about three or four inches above the
wrift; it goes down to the root of the little finger, and
gives the chief arches in the palm of the hand, and all
the arteries of the fingers, faving only the inner fide of
the fore finger. The radial artery goes off like a branch
from the ulnar, or, in other words, the ulnar feems to
continue in the courfe of the main artery, while the ra-
dial goes off to one fide; it makes its appearance as a
fuperficial artery much higher in the fore-arm than the
ulnar does; it turns backwards over the wrift, or root
of the thumb, and it gives all the arteries of the thumb
and forefinger, as the ulnar does of the other fingers.
The interoffeous, again, is truly a branch from the ul-
nar; it comes off where the ulnar lies deepeft; it runs
along the interoffeous membrane, whence its name; it

belongs

belongs to the deep mufcles of the arm ; it fcarcely
paffes the wrift, or at leaft mounts but a very little way
along the back of the hand.

These are the great divifions of the artery ; but be-
fore entering upon thefe, it will be well to fet apart and
defcribe one particular fet of arteries, viz. the recurrents ;
both becaufe they belong in a peculiar manner to the
joint, and becaufe the recurrents, from which-foever of
the great arteries they come, ftill ferve the fame office,
viz. of inofculating with thofe from the above joint ;
though, after all, this part of their office attracts our at-
tention, chiefly becaufe we depend upon thefe inofcula-
tions for our fuccefs in operations for aneurifm, though
unqueftionably the chief ufe of thefe arteries is to fupply
the joint and adjacent parts ; and their inofculations are
but a fecondary office.

ARTERIÆ RECURRENTES.

THE recurrent arteries are fmall arteries correfponding
with the anaftomofing arteries from above. They turn
quickly backwards almoft as foon as they are clear of
the main arteries from which they arife : they encircle
the whole joint, for they are no lefs than four, or fome-
times five in number ; one from the radial, two from the
ulnar, and one from the interoffeous artery.

RECURRENS RADIALIS ANTERIOR.

THE ANTERIOR RECURRENT of the RADIAL artery
is the firft branch which it fends off, excepting a fmall
branch to the fupinator and fkin. The place where the
radial recurrent is to be found, is deep in the hollow
betwixt the brachialis internus or mufcle of the arm,
and the extenfor radialis or firft mufcle of the fore-arm,
viz. that which conftitutes its outer edge. The recur-
rent lies upon the fore-part of the joint, where the outer
condyle is : the mufcles which lie over this recurrent
artery, or near it, are the two flexors of the wrift, the
fupinator longus, and the biceps, and thefe receive its
firft branches ; and one of its branches runs down along

the tendon of the fupinator. Its next branches go lefs regularly to the other mufcles of the fore-arm, as to the pronator teres, and to the flexors of the fingers; it has one SUPERFICIAL ANASTOMOSING artery, whofe anaf-tomofes are not upon the naked joint; but, on the con-trary, the branch mounts along the fore-part of the bra-chialis internus mufcle, and inofculates under the biceps with the leffer or lower profunda. A fecond anafto-mofing branch goes deeper; it paffes through the flefh or belly of the brachialis, and anaftomofes with the ramus anaftomoticus major from above. A third anaf-tomofing branch is the chief branch; it lies deeper ftill upon the fore-part of the joint, in the hollow which I have lately mentioned : it runs up under the belly of the fupinator, along the fore-part of the fhoulder-bone, where it inofculates with the upper profunda humeri, and chiefly with its greater branch called fpiral artery; which turns round the bone, and ends here over the outer condyle.

This is the recurrens anterior of the radial artery; but none of thefe branches have I ever feen or felt to be enlarged after operations for aneurifm. The fuccefs of that operation depends entirely upon the arteries next to be defcribed, viz. the ulnar recurrents, which are always two in number; but fometimes thefe two recur-rents go off in one branch from the ulnar : in which cafe, viz. of a fingle recurrent coming off from the ulnar, it divides immediately into two branches, and the one takes the fore and the other the back part of the joint.

RECURRENS ULNARIS ANTERIOR.

THE ANTERIOR RECURRENT of the ULNAR artery goes off the firft of the branches, immediately before it gives off the interoffeous, and where the artery lies deep in its triangular hollow. This anterior artery paffes up under cover of the pronator teres, lies clofe upon the fore-part of the inner condyle, and is of importance, not only by its own fize, but alfo by its anaftomofing with
the

the ramus anaſtomoticus major, which is the largeſt of the arteries from above.

RECURRENS ULNARIS POSTERIOR.

THE POSTERIOR RECURRENT of the ULNAR artery is often a branch of the anterior one, coming off with it in one common trunk. When it comes off apart, it ariſes a little lower; it is a larger and ſtronger artery, i. e. it makes as full inoſculations, goes farther, and gives more branches to the muſcles. This poſterior re- current ariſes from the ulnar at that place where it per- forates the bellies of the flexor muſcles; it alſo dives through betwixt the two bellies of the flexor muſcles of the fingers, it thus gets round the condyle, for theſe two muſcles ariſe together, from the condyle: the artery gives many branches both to the pronator and flexor muſcles, and to the perioſteum, and capſule of the joint; it then lodges itſelf in that deep hollow which is betwixt the olecranon and the condyle, where the ulnar nerve lies (that nerve which we feel ſo benumbed when we ſtrike the inner ſide of the elbow). The artery, ſtretching upwards along the bone, meets a ſimilar de- ſcending branch from the upper profunda, and inoſcu- lates with it. As far as we yet know, the whole weight of the buſineſs in ſaving the arm after aneuriſms depends upon theſe two arteries. In Mr. White's preparation it is the anterior branch which is enlarged, inoſculating with the anaſtomoticus major over the fore-part of the inner condyle. In a preparation which I have, it is the poſterior artery which runs tortuous and enlarged behind the inner condyle: but I muſt add to the authenticity of this preparation, by noticing, that I have ſeveral times felt diſtinctly, after ſucceſsful operations for the aneuriſm, that it was this poſterior artery that was en- larged.

RECURRENS INTEROSSEA.

THE RECURRENT of the INTEROSSEOUS artery is the firſt of its branches, though ſometimes this recurrent

riſes

rifes from the ulnar a little above the interoffeous. This artery going to the middle and back part of the joint is very conftant; it firft fends one fmaller branch forwards towards the root of the brachialis internus mufcle, which inofculates over the fore-part of the joint with the ramus anaftomoticus magnus, and with the ulnar and the radial recurrents; but thefe inofculations and this an-terior branch are of fmall importance. The chief branch goes through that lacerated-like hole which is in the upper end of the interoffeous ligament; and the artery having paffed through this hole, and got to the back of the joint, it runs for two inches upwards along the back of the olecranon, contributing greatly to form, by its inofculations with both branches of the profunda fupe-rior, that net-work of arteries which covers all the back-part of the joint, and which belongs chiefly to the joint, to the capfule, and to the bones which form the joint.

From thefe anaftomofing branches which belong to all the three arteries, we now return to defcribe the general courfe of the three great arteries; and firft of the radial.

ARTERIA RADIALIS.

THE RADIAL ARTERY is properly the firft branch of the ulnar; it goes off from it at a pretty obtufe angle in the bend of the arm; it paffes under the pronator mufcle, emerges from under it above the middle of the arm, follows the long tendon of the fupinator, and runs under it down to the root of the thumb; it is at the root of the thumb only that it divides into its great branches: and a clear proof that in its courfe down the fore-arm it gives off none but fmall and irregular muf-cular branches, is this, that it preferves almoft an equal diameter in all its progrefs from the elbow to the wrift.

This is the artery which lies naked upon the radius at the wrift, where we feel the pulfe. It lies more fu-perficial, lefs imbedded in mufcles, than the ulnar ar-tery; for fix inches above the wrift there is to be felt

nothing

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nothing but the naked artery, the fharp tendon of the fupinator, and the bone. The radial artery, as to its courfe down towards the wrift, is direct; but with regard to itfelf, it is tortuous, with fhort and gentle wavings. Of its branches, as it moves down the fore-arm, there is not one that is worthy to be named. Firft, it gives a branch to the fupinator, and to the extenfors of the carpus; then it gives the radial recurrent, already defcribed; then, having gone a little deeper among the mufcles, it repeats its branches to the fupinator and extenfors; but being deep, it gives alfo twigs to the pronator and to the flexor radialis, inofculating with the interoffeous arteries. Next the radial artery, emerging from among the thickeft of the mufcles of the fore-arm, becomes fuperficial, touches the naked radius, and runs along it, with the belly of the flexor pollicis below it, and the long tendon of the fupinator above it. Here are no mufcles lying on the outfide of it, nothing but the tendon; and therefore all its twigs are downwards to the flexor pollicis, upon which it lies; to the flexor digitorum, which lies next to that; and to the flexor radialis and the palmaris longus. Next it gives deeper branches, viz. to the pronator quadratus; and alfo it gives fmall twigs, which accompany the feveral tendons along the naked bone. Arrived at the wrift, it does not divide, as authors have reprefented, into two branches, viz. a palmar and a dorfal artery; this is indeed a very rare occurrence: the radial artery paffes on undivided to the root of the thumb, and there divides into three great branches; one to the thumb, one to the fore finger, and one to the palm of the hand: it does indeed, while it is paffing the wrift, give two confiderable branches, one to the palm, and one to the back of the hand; yet they are but branches.

ARTERIA SUPERFICIALIS VOLÆ.

THE firft branch, then, of the radial artery, after arriving at the wrift, is that which goes acrofs the palm of the hand, and may be named the SUPERFICIAL ar-

tery

tery of the PALM. It goes off juft where the main artery is about to turn over to the back of the hand; it paffes in general through the flefh of the thumb, going under the root of the ABDUCTOR BREVIS POLLICIS. This artery we generally find dividing into three branches: The firft is a more fuperficial branch, which croffes the palm of the hand, and gives its twigs to the fkin, palmar aponeurofis, annular ligament, and all the tendinous parts about the joint: The fecond is a larger and more important branch; it is the middle branch of thefe three; it goes deep; and having given feveral branches to the mufcles about the root of the thumb, and to one or two of the interoffei mufcles, it makes a large inofculation with the great palmar arch, which feems to be inde d the chief tendency of the whole artery: The third branch is lefs regular than the others; it mounts along the root of the thumb, and belongs to its outer edge *.

The next branches of the radial artery are very fmall and namelefs twigs, which go to the naked part of the wrift, to the tendons, ligaments, and the bones; and then comes the artery oppofite to this artery of the palm, viz. the artery of the back of the hand.

ARTERIA DORSALIS CARPI.

THE ARTERY of the BACK of the HAND comes off from the radial, juft after it has turned over the radial edge of the wrift. It takes its courfe directly acrofs the back of the hand, over the carpal bones; and by its frequent inofculations with branches from the ulnar artery, and with the dorfalis metacarpi or dorfalis manus, it makes beautiful net-works acrofs all the naked part of the back of the hand.

* This branch anatomifts have thought fit to call ARTERIA ULNARIS RADIALIS POLLICIS, which involves fuch a complication of contradictions, that, upon reading it, one would naturally turn to the table of errata. The artery is called radialis, becaufe it comes from the radial artery; and ulnaris pollicis, becaufe it goes upon the ulnar fide of the thumb.

DORSALIS METACARPI.

THE RADIAL ARTERY, continuing its courfe under the extenfor tendons of the thumb, fends off the dorfalis metacarpi, which is an artery generally larger than the laft; it takes its courfe acrofs the back of the hand and over the metacarpal bones, and from this artery are given off the interoffeous arteries.

The firft interoffeous artery of the hand is large, long, goes up in a direct courfe to the fork betwixt the fore and mid fingers, and plunges into the cleft of the digital artery at right angles with it. A fecond twig like this, and then a third are given off; named the firft, fecond, and third interoffeous arteries: but they are all fmaller than the firft, and all the three communicate with the arteries from the palm.

Before the final divifion of the radial artery* into its three branches, it gives a third artery, or, as often happens, two arteries, to the back of the thumb.

ARTERIA DORSALIS POLLICIS.

THE fmall artery, or the two fmall arteries which, from going along the back of the thumb, are named arteriæ dorfales pollicis, come off either along with, or immediately after, the dorfalis carpi. When there are two, they run both along the back of the thumb, one on one fide, the other on the oppofite fide; that which runs along the outer edge of the thumb paffes through under the tendons, and is rather fhorter; that which inclines to the inner fide of the thumb is rather longer. Thefe fmall arteries on the back inofculate round the edges of the thumb with the great artery on the inner fide; which is next to be defcribed.

Thus we have feen that the radial artery, having ad-

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* Notwithftanding the inconfiftency of retaining the name of radial artery, after the artery has paffed the wrift, and begun to run along the thumb, I venture to facrifice verbal accuracy, and would make much greater facrifices to obtain a clear arrangement.

vanced

vanced to the wrist, turns quick round the wrist, over
the head of the radius, and under the tendons of the
thumb; it gives immediately before it passes, the artery
of the palm; it gives immediately after it passes, the
artery of the back of the wrist; it gives immediately
after that the artery to the back of the hand; and then
the little arteries for the back of the thumb; it then
mounts along the thumb in that hollow which is by the
side of the metacarpal bone of the thumb, till it arrives
at the cleft betwixt the thumb and fore-finger. Here it
divides into three arteries; one to the inner side of the
thumb, very large; another to that side of the fore-
finger which is next the thumb, which branch is much
smaller; and one which exceeds these in importance,
for it dives down into the palm of the hand, forms what
is called the deep arch of the palm; and which, having
crossed the palm, forms on the side next the little finger
that inosculation betwixt the upper and lower arches
which is so much celebrated.

ARTERIA RADIALIS INDICIS.

The artery of the fore-finger proceeding from the
radial artery is the first and smallest of these three
branches. It goes off at the root of the metacarpal
bone of the fore-finger, goes up along its interosseous
muscle, and runs along all the edge of the fore-finger
next the thumb, inosculating with the artery of the
opposite edge, which comes from the ulnar arch; it
sends off twigs at its root, which inosculate with the
small dorsal arteries of the thumb; and it gives a branch
to the adductor indicis.

ARTERIA MAGNA POLLICIS.

The chief artery of the thumb rises along its
metacarpal bone, a single artery, and there splits com-
monly, I think, into three smaller branches. Two
of these run along the fore-part of the thumb up to its
extremity, and inosculate there; the one running along
the

the radial, the other along the ulnar fide, till they meet at the point. Thefe are, as it were, counterparts of the dorfal arteries, but greatly larger, the thumb being naked on the back, but flefhy where it looks towards the palm. Another branch of the arteria pollicis is one which turns to the palm of the hand, and runs towards the fore-finger.

ARTERIA PALMARIS PROFUNDA.

The third branch of the radial artery, and that by which it ends, immediately fucceeds the artery of the thumb. It croffes the palm of the hand fo as to form the deep arterial arch, or the radial arch of the palm; it lies under the aponeurofis, and all the tendons and mufcles clofe upon the metacarpal bones. Having gone its circle fo as to complete the arch, and having arrived at the root of the little finger, or rather lower, near the pifiform bone, it turns backwards with a fudden ferpentine turn, and enters into the fide of the ulnar arch, fo as to make a complete inofculation.

This deep palmar arch gives out many arteries; but as it lies clofe upon the bones, they are all of the fmalleft order of arteries, and go only to the bones, and to the joints of the carpus and metacarpus. Thofe branches again which run upwards, give little arteries to the interoffei mufcles, to the lumbricales, to the long tendons, and to the interftice of each bone. Small twigs are fent through to the back of the hand, which are named arteriæ perforantes, and which inofculate with the dorfalis carpi, or artery of the back of the wrift; they alfo inofculate with the arteries of the fingers.

ARTERIA ULNARIS.

The ULNAR ARTERY, both from its fize and its direction, is to be confidered as the continued trunk of
the

the humeral artery.   It dives downwards and backwards
into the triangular hollow which has been defcribed, till
it touches the interoffeous membrane : It firft gives off a
fmall branch to the pronator teres and common origin
of the flexor mufcles, before it paffes through them :
Sometimes it gives off here the recurrent, which fhould
come from the interoffeous artery ; in which cafe that
branch, as it paffes backwards through the interoffeous
membrane, is named interoffea pofterior fuprema.   Next
the ulnar gives off the proper interoffeous artery, which
is named INTEROSSEA COMMUNIS, becaufe both the an-
terior and pofterior arteries are branches of it.   Then the
ulnar artery, lodged deep under all the mufcles which go
off from the inner condyle, as the palmaris, pronator
teres, flexor ulnaris, &c. perforates one of them, viz.
the flexor digitorum.   But though it paffes through
betwixt the upper and lower flexor, it does not, like
the radial, appear immediately as a fuperficial artery ;
it fhows itfelf only about three inches above the wrift.
The ulnar artery, running along by the tendon of the
flexor carpi ulnaris, paffes forward from the wrift to the
palm of the hand by the fide of the pifiform bone ; it
then forms the fuperficial arch of the palmar arteries,
and fupplies all the fingers, as the radial fupplies the
thumb.

The arteries which the ulnar gives out after it paffes
through the mufcles, and before it arrives at the wrifts,
are merely mufcular branches, extremely variable in
fize and number.   To enumerate thefe would be but to
repeat the names of all the mufcles which lie upon the
flat part of the fore-arm.

As the radial fends a branch over the back of the
hand, named dorfalis radialis, fo does this fend a branch
round the back of the little finger named dorfalis
ulnaris.

ARTERIA DORSALIS ULNARIS.

THE DORSALIS MANUS ULNARIS is a fmall branch
which goes off from the ulnar artery as it advances
                                                    towards

towards the wrift. The ulnar artery goes forwards towards the pifiform bone, while this little artery turns off about two inches below, paffes under the tendon of the flexor ulnaris, and round the head of the ulna, to the back of the hand; it then goes upwards along the back of the little finger, where it ends. It gives branches as it paffes along to the pronator quadratus, to the extenfor ulnaris, to the joints about the lower part of the wrift, and efpecially to the joining of the radius with the ulna; and it finifhes on the back of the hand by arteries given to the tendons and capfule, by inofculations with the rete which is formed upon the back of the wrift, by the radial artery, and by giving the dorfal artery of the little finger.

Next the ulnar artery, before it begins its arch, gives fmall branches to the flexor tendons and fore-part of the wrift; others to the pifiform bone, to the annular ligament, and to the palmaris cutaneus, and then branches to the flexor, abductor, and adductors of the little finger; or, in other words, to all that mafs of mufcular flefh which furrounds the root of the little finger; and ftill, before it begins to bend into an arch, and juft beyond the pifiform bone, it gives off that branch which may be called ARTERIA PALMARIS PROFUNDA.

ARTERIA PALMARIS PROFUNDA.

THE defcription of this artery is fhortly this: It is but a fmall artery; it comes off a little lower than the pifiform bone; it often gives the laft lateral artery of the little finger; it then turns downwards and backwards with a large circle, paffes through betwixt the two heads of the flexor digiti minimi; by this it gets into the deepeft part of the palm, and there joins itfelf with that palmar branch of the radial artery which comes off at the root of the thumb; and by this inofculation the deep palmar arch is completed.

The ulnar artery having now arrived at the root of the metacarpal bones, but above the tendons of the fingers, forms a great arterial arch acrofs the palm of the hand, which

which is named the SUPERFICIAL PALMAR ARCH; and this arch gives out the arteries for the fingers after the following order: It does not give off two arteries to each finger, one for each fide, becaufe it does not lie at the root of the fingers: but inftead of this it fends out three fingle arteries; each of thefe goes to the cleft betwixt two of the fingers; and when arrived at the roots of the fingers, thefe branches divide uniformly and regularly into two branches; of which one goes up along the fide of one finger, while the other goes up the oppofite fide of the next finger; and thus all the fingers are fupplied each with two arteries, one running along either edge of each finger. To number them according to the fingers one, two, three, were mere drudgery and wafte of time; and to name and defcribe them were an abfolute abufe, fince they are fo uniform in all points: It is fufficient to obferve, that a long and flender artery runs along each edge of each finger; that generally at each joint or divifion of the finger the two arteries make arches to meet each other acrofs the hollow where the tendons lie, fupplying the tendons and ligaments at the fame time; and that the fork of each digital artery receives a branch from the deeper arch of the palm. That the arteries are each accompanied with correfponding nerves, one for each fide of each finger; for the ulnar nerve accompanies the ulnar artery down the fore-arm, and branches along with it in the palm into the form of an arch, with three branches; which three branches are afterwards divided like the arteries, each into two twigs at the roots of the fingers.

The fuperficial palmar arch finifhes with a fmall branch, which makes another inofculation at the root of the thumb with that fuperficial palmar branch which comes off from the artery of the thumb, near the place where the artery of the fore-finger alfo comes off.

ARTERIA INTEROSSEA.

THE INTEROSSEOUS ARTERY is, after the radial and ulnar, the laft of the arteries of the fore-arm. It is but a branch of the ulnar; it arifes from the ulnar juft
where

where it lies in the very deepest part of the arm, touches the interosseous ligament. This artery is named INTEROSSEA COMMUNIS, becaufe of two lesser interosseous arteries into which it divides. First the interossea communis divides about an inch below the elbow into the interossea anterior and interossea posterior; next the interossea posterior gives off the posterior or interosseous recurrent. That artery is already described; and I proceed to describe now the course of the two interosseous arteries.

First, The anterior interosseous artery is the continued trunk, for it goes straight forwards, and is larger; while the posterior interosseous is smaller, turns out of the straight course to perforate the membrane, and is exhausted before it reaches the wrist.

The anterior interosseous artery lies flat upon the forepart of the interosseous membrane; is larger than a crow-quill, or about half the diameter of the radial artery. As it goes down the fore-arm, it gives branches to all the muscles; it gives the nutritious arteries of the radius and ulna; it goes forwards, and, ending in small branches under the annular ligament of the wrist, it makes beautiful net-works and anastomosis over the capsular joints of the carpus.

Secondly, The posterior interosseous artery turns through the interosseous ligament about two inches below the elbow-joint. It instantly gives off the interosseous recurrent; which being very large, the artery seems to be divided into two equal branches, of which one is the recurrent, turning upwards towards the elbow-joint; the other is the posterior interosseous itself, running downwards, and distributing its branches among all the great bellies of the extensor muscles which lie on the outside of the fore-arm.

Thirdly, There is something like a second interossea posterior; for the anterior interosseous artery sends off, about four inches above the wrist, another artery, but much smaller, which perforates the interosseous membrane; might be called a second posterior interosseous; though it is rather to be reckoned among those smaller

twigs

twigs which, coming off from the anterior interosseous, and perforating the ligament, go through it to the exten- for mufcles, and are named PERFORATING ARTERIES, being from about four to feven in number.

CHAP. III.

OF THE ARTERIES OF THE THORAX, ABDOMEN, AND PELVIS.

§ I. ARTERIES OF THE THORAX.

AORTA THORACICA.

THE aorta from the arch (where the fubclavians and carotids go off) bends downwards and backwards, and touches the left fide of the fpine. The two mem- branes called pleura of the right and left fide meet in the middle to form the mediaftinum ; but as they do not meet immediately, they leave a triangular fpace, the bafis of which triangle is the fpine ; the fides are the two mem- branes of the pleura, inclining towards each other ; and there, in the interftice betwixt them, the aorta is lodged, and along with it lies the œfophagus, which runs down- wards towards the ftomach. The thoracic duct, which is paffing upwards to the fubclavian vein, and the vena azy- gos, which returns the blood of the thorax, and brings it into the defcending cava ; thefe parts are all involved in cellular fubftance, and inclofed in this triangular fpace betwixt the two membranes.

The aorta, as it goes thus downwards befides the fpine, gives the following branches : Firft, As it lies immedi- ately

ately behind the root of the lungs, it gives fmall arteries which nourifh the proper fubftance of the lungs, the bronchial arteries: Secondly, As it lies by the fide of the œfophagus, it fupplies it with fmall twigs, the œfophageal arteries: Thirdly, The aorta, as it moves downwards through the thorax, gives off a fmall and regular artery to the interftice of each rib as it paffes it; and thefe are the INTERCOSTAL ARTERIES.

The BRONCHIAL arteries are always three, and fometimes four, in number. Their office is not to contribute to the oxydation of the blood; that office belongs peculiarly to the pulmonic artery, while the fmall bronchial arteries are for nourifhing the proper fubftance of the lungs; for which end they attach themfelves immediately to the trachea, and follow its branches, twifting round them through all the fubftance of the lungs.

I. ARTERIA BRONCHIALIS COMMUNIS.

THE COMMON BRONCHIAL ARTERY, fo named becaufe it gives branches to both fides of the lungs, arifes higheft from the fore-part of the aorta; it gives two branches, one to the right fide of the lungs, and one to the left; the right branch gives an artery to the œfophagus, and fometimes the whole of the right branch goes to that part.

2. ARTERIA BRONCHIALIS DEXTRA.

THE RIGHT BRONCHIAL ARTERY fometimes, like the common bronchial, comes off from the aorta; but very often it comes off from the upper intercoftal artery. It goes round the right branch of the trachea, and belongs to that fide of the lungs alone: but it gives, notwithftanding, fome branches to other parts, efpecially to the œfophagus, to the back of the pericardium, and to the pofterior mediaftinum, or membrane which ftrides acrofs the aorta.

3. ARTERIA

3. ARTERIA BRONCHIALIS SINISTRA.

THE LEFT BRONCHIAL ARTERY comes off along with the bronchialis communis from the fore-part of the aorta; it goes to the left fide of the lungs, and. alfo affords fmall branches to the œfophagus and neighbouring parts.

4. ARTERIA BRONCHIALIS INFERIOR.

OFTEN there is a fourth bronchial artery, which we would call BRONCHIALIS INFERIOR, or the LOWER BRONCHIAL ARTERY, becaufe it comes off lower than thefe, commonly about the place of the fifth rib. It goes to the back of the heart, where the pulmonic vein of the left fide expands into the auricle, and taking the pulmonic vein as a conductor, creeps backwards along it into the fubftance of the lungs.

Thefe bronchial arteries are the leaft regular in all the body, coming off ufually from the aorta, but fometimes from the mammary, and often from the upper intercoftal artery; fometimes alfo they arife from the intercoftals of the aorta. But from one or other of thefe fources we ufually have three or four bronchial arteries, which are fo named from their belonging to the branches of the trachea or bronchiæ.

Ruyfch, who firft difcovered this artery, and Sylvius de la Boe and others who followed Ruyfch, and ufed his words in defcribing the artery, explained its office truly: they faid it was for nourifhing the fubftance of the lungs. But this fenfible opinion was difputed by many phyficians of very great reputation; who maintained that it was quite difproportioned to the fize of the lungs, and that it nourifhed the trachea only; and they gave a moft whimfical reafon for believing all this. The lungs they confider as made of very coarfe ftuff, which the half elaborated blood of the right ventricle and pulmonic artery might ferve; while the harder and more perfect fubftance of the trachea required a more perfect and finer blood.

5. ARTERIÆ

5. ARTERIÆ ŒSOPHAGEÆ.

THE ŒSOPHAGEAL ARTERIES are generally five or fix in number. They are fmall twigs which come off from the aorta below the bronchial arteries; they encircle the œfophagus, and make anaftomofes with each other; and very generally they pafs off from the œfophagus to the pofterior mediaftinum, or that double membrane under the interftice of which the aorta lies. Thefe fecondary arteries, along with very fmall twigs which come off from the aorta itfelf, fome anatomifts choofe to defcribe apart under the title of pofterior mediaftinal arteries.

6. INTERCOSTALES INFERIORES.

THE LOWER INTERCOSTAL ARTERIES are nine or ten in number, according to the number of ribs which are not fupplied by the upper intercoftal artery (for the upper intercoftal, which comes downwards from the fubclavian artery, fupplies ufually the intercoftal fpaces of the two firft ribs), but fometimes of three, and fometimes of one only. The aorta, in its courfe down the back, gives out, as it paffes each vertebra, one artery for each rib; as it goes down along the loins it ftill gives off an artery at the interval of each vertebra; in the thorax they are named INTERCOSTAL, and in the loins the LUMBAR arteries.

The right intercoftals are longer, becaufe they have to mount over the ridge of the vertebræ; the left ones are fhorter, becaufe the aorta lies on that fide of the fpine: the intercoftals often give fmall twigs to the œfophagus and mediaftinum; but befides thefe, each intercoftal artery gives three principal branches.

1. By the head of each rib it gives a fmall artery, which belongs entirely to the fpine, and this artery fends one twig to the fubftance of each vertebra; another twig goes to the fheath or dura mater of the fpinal marrow; the third following each intercoftal nerve backwards;

wards, enters into the subftance of the fpinal marrow itfelf.

2. Each intercoftal gives next a larger artery, which perforates near the head of each rib, and paffes through to the back, and fupplies the longiffimus dorfi, latiffi-mus dorfi, facro-lumbalis, and all the great mufcles of the back, which have indeed no other fource whence they can derive arteries ; and though thefe are appa-rently fmall for fo great a mafs of mufcular flefh, the fmallnefs of the branches is compenfated for by their frequency.

3. The intercoftal artery proceeds, after giving thefe branches, along its proper intercoftal fpace, where it gives an immenfe number of fmall arteries to the inter-coftal mufcles ; and as each artery paffes round the tho-rax along the ribs, it fplits into two branches ; one at-taches itfelf to the lower edge of the rib above it, where there is a fort of groove to receive it, that is, the larger artery, and the artery which is to be feared in wounds or operations ; the other attaches itfelf to the upper fharp edge of the lower rib, where there is no groove ; this of courfe is the fmaller branch, much lefs important in all refpects. Thefe two accompanying each rib, run round the circle of the thorax to its fore-part, and inofculate with the mammary and epigaftric arteries.

§ 2. ARTERIES OF THE ABDOMEN.

AORTA ABDOMINALIS.

THE aorta defcends into the belly under that arch which is formed by the legs of the diaphragm. It paffes along the left fide of the fpine ; but now upon emerging into the abdomen, it inclines nearer to the middle of that ridge which is formed by the vertebræ. The flat and tendinous legs of the diaphragm not only
ftride

ftride over the aorta, fo as to form an arch apparently for its protection; but the uppermoft part of the crura turns flat under it, fo as to embrace it. No vein goes along with the aorta; for the cava, which returns all its blood, leaves it a little above the pelvis, and inclines towards the right fide, that it may enter into the right fide of the heart, which it does by paffing under the liver.

But the aorta has other very important connections; for as one of its firft arteries is the great artery of the inteftines, of courfe the root of the mefentery (the membrane which conducts the arteries of the inteftines) lies over the aorta; and as the mefentery conducts the lacteals from the inteftines, of courfe the meeting of the lacteals and of the lymphatics, or, in other words, the beginning of the thoracic duct, is at the fide of the aorta. Again, as the great nerves which come down from the breaft into the abdomen are deftined chiefly for the vifcera, they have no other way of reaching the vifcera than by taking the direction of the feveral branches which the abdominal aorta gives out. There are three great branches; the cœliac, the fuperior mefenteric, and the inferior mefenteric arteries. Of courfe there are three great plexus of nerves; the cœliac plexus, the fuperior mefenteric plexus, and the inferior mefenteric plexus. As thefe net-works all come from the greater net-work which covers the aorta itfelf, that plexus is named, from its great fize and from its many radiated nerves, the folar plexus; and the femilunar form of the two great nerves which fupply the whole gives them the name of femilunar ganglions.

Thefe connections of the aorta, deduced in this general way, will be eafily underftood; will fhew the importance of ftudying this point, where there are fo many intricate parts; and will explain alfo the neceffity of mentioning this group of difficult parts at once.

The aorta then paffes from the thorax into the abdomen, through betwixt the legs of the diaphragm; the beginning of the thoracic duct lies a little below this point, and the duct itfelf runs up by the fide of the aorta.

The

The Aorta, having come out into the abdomen, the firſt branch which it gives off is a ſmall one to the diaphragm as it paſſes under it. The next branch which it gives off is the moſt important of all, viz. the cœliac artery; and it ſupplies the ſtomach, the liver, and the ſpleen, becauſe they lie in the upper part of the abdomen. Next it gives a great artery to the inteſtines, which is named the ſuperior meſenteric artery; for it goes to the inteſtines which lie within the abdomen. Then it gives the arteries to the kidnies and the ſpermatic veſſels. And, laſtly, it gives off a great artery, which is named lower meſenteric; becauſe it ſupplies chiefly the lower part of the great inteſtines, and moſt eſpecially the rectum, where it goes down into the pelvis.

Then the aorta divides into the two iliac arteries, and of courſe has no longer the name of abdominal aorta.

ARTERIÆ PHRENICÆ.

THE diaphragm has in nine of ten bodies two arteries named the PHRENIC ARTERIES; one going to the right ſide, the other to the left. The varieties of this artery are too great almoſt to be mentioned; but, however, theſe are the chief: Generally the phrenic arteries are two ſmall arteries ariſing from the aorta, one going to the right ſide, another to the left; often there is one artery going off from the fore-part of the aorta, and dividing immediately into two arteries, right and left; ſometimes one ariſes from the aorta itſelf, another from the cœliac artery; ſometimes the cœliac artery, which has properly but three branches, has a fourth added, which is the phrenic artery; ſometimes there are three phrenic arteries; ſometimes even four; and the diaphragm, it is always to be remembered, receives often ſmaller branches from the intercoſtal and lumbar arteries, or from the capſular arteries, beſides thoſe which it gets from the thorax accompanying its nerves and coming along the pericardium.

Theſe varieties being mentioned, the hiſtory of the regular

regular phrenic arteries may be very fhort. One goes round the right fide of the diaphragm, and the other round the left, with very little variety. Firft, the phrenic artery croffes what is called the flefhy part of the crus diaphragmatis of its own fide, and goes bending along to what is called the ala or wing of the diaphragm, and gives a great many arteries in all directions into thefe flefhy fides of the diaphragm; the artery then turns round, and encircles the great central tendon, where the two phrenic arteries begin to turn round : they give one branch particularly large to the flefhy fides of the diaphragm, which arife from the ribs ; then bending round the central tendon, they fpread all their remaining branches forwards upon the central tendon, and upon that part of the mufcle which arifes from the fternum, and meet in large inofculations with each other. One branch often pierces the diaphragm, goes into the pericardium where it is attached to the diaphragm, and unites with that artery which comes down along with the phrenic nerve, the comes nervi phrenici.

But ftill it is to be remembered, that the phrenic arteries, before they enter into the diaphragm, give fmall arteries to the capfulæ renales, and to the œfophagus and neighbouring parts ; the œfophagean branch running upwards into the thorax, to inofculate with the upper arteries of the œfophagus.

§ 3. OF THE ARTERIES OF THE STOMACH, LIVER, AND SPLEEN.

The upper part of the abdomen is occupied entirely by the ftomach, liver, and fpleen ; the ftomach in the middle, the liver on the right hand, and the fpleen on the left. The cœliac artery fupplies all thefe parts ; it

rifes

rifes up from the fore-part of the aorta a fhort thick artery encircled by the leffer arch of the ftomach ; and immediately fplits into three branches, of which the middle branch goes to the ftomach, the left goes to the fpleen, the right goes to the liver ; and thus we have all the branches of the cœliac artery neatly and fimply arranged.

ARTERIA CŒLIACA.

THE CŒLIAC ARTERY is fo important, that its place and connections muft be more minutely defcribed. It arifes from the fore-part of the aorta, juft at that place where the aorta is clofely embraced by the crura dia-phragmatis, and over the eleventh vertebra of the back ; it juts directly forwards, almoft at right angles from the aorta, and is encircled by the leffer arch of the ftomach ; the artery ftanding up betwixt it and the diaphragm. The cœliac trunk, then, is fo placed as to be furrounded by thefe parts ; it has the œfophagus on the left hand ; the lobulus fpigelii, or lobulus papillaris of the liver, on the right hand ; it has the leffer arch of the ftomach making its turn under it ; and it has the diaphragm above, and the pancreas running acrofs below ; it is covered by the delicate web of the omentum, named omentum minus, which goes from the leffer arch of the ftomach to the liver and to the fpine.

Now this fhort jutting out or ftump we call the trunk of the cœliac artery ; or we call it axis arteriæ cœliacæ, for there is no other artery of the body that divides like it : the ftump, which is lefs than half an inch in length, ferving as an axis, from which the three great branches, viz. to the ftomach, liver, and fpleen, go off all at once, in a tripod-like form ; one upwards, one to the right, and one to the left. The hepatic, which goes to the right, is largeft in the child, becaufe of the great bulk of its liver ; the fplenic, which goes to the left, is larger in the adult ; the gaftric is almoft always the fmalleft of the three.

I. ARTERIA

I. ARTERIA CORONARIA VENTRICULI.

THE CORONARY ARTERY of the STOMACH is the central artery of the tripod. When it belongs entirely to the ftomach, it is fmaller than the fplenic or hepatic arteries : but when it gives (as often it does) a branch to the liver, it is the largeft of the three. This gaftric artery, or coronary artery of the ftomach, is generally the fmalleft, not very much larger than a crow-quill ; it rifes upwards, and turns a little towards the left fide, becaufe the pyloric orifice of the ftomach is there.

Before it reaches the pyloric orifice of the ftomach, it divides itfelf into two great branches ; one going round the cardiac orifice of the ftomach, and the other returning along the leffer arch.

CORONARIA SUPERIOR VENTRICULI.

THE branch which belongs to the cardiac orifice of the ftomach attaches itfelf to the œfophagus, juft where it emerges from the diaphragm, and is joined to the ftomach : the artery turns round the œfophagus, paffes firft under and behind it, and then turns round and appears on the fore-part, or rather on the left fide, of the ftomach to fpread over it. In the middle of this turn it gives off an artery which runs backwards along the œfophagus, takes directly the line of the œfophagus, runs up with it into the thorax a confiderable way, inofculates with the upper œfophagean arteries, and though a fmall branch, it is long, and feldom wanting. The fecond branch is a continuation of the fame artery encircling the cardiac orifice, fending its arteries down over the large and bulging part of the ftomach, fomewhat in the form of a crown. As the fpleen is attached to this end of the ftomach, this artery inofculates with what are called the vafa brevia, or fhort veffels coming from the artery of the fpleen ; and fo it ends, having the name of CORONARIA SUPERIOR VENTRICULI.

P 4

The

The fecond branch of the coronary returns along the leffer arch of the ftomach; it is fo connected with the laft that it may be called ramus coronariæ dexter, though properly it is not a branch, but the continued trunk of the gaftric artery. As the firft branch turns round behind the œfophagus, this ftops and turns to the leffer arch of the ftomach, touches it juft at the cardiac orifice, *i. e.* at the root of the œfophagus; turns with a gentle turn round the leffer arch of the ftomach, bending as the arch bends, giving its branches down both forwards and backwards over each fide of the ftomach. As it runs along the ftomach it is fenfibly exhaufted by thefe arteries, fo that it arrives very fmall at the lower or pyloric orifice of the ftomach; there it turns over from the ftomach upon the fmall gut in fuch a way as to belong to the pylorus or union of the gut with the ftomach; and though fmall and trivial, it has an appropriated name, ARTERIA PYLORICA SUPERIOR, and thus the gaftric artery ends.

But fometimes, as has been mentioned in the general defcription, the gaftric artery fends a branch to the liver; yet, in that cafe, the order of thefe arteries already enumerated is in no degree difturbed; the artery running along the œfophagus, the artery running round the cardia and in form of a crown, the artery returning along the leffer arch, are ftill the fame; only, after giving off this laft artery, the trunk of the gaftric goes off from the ftomach, continues its courfe towards the liver, and paffes into it.

2. ARTERIA HEPATICA.

THE HEPATIC ARTERY goes off from the cœliac axis, where it almoft touches the point of the Spigelian lobe. The pancreas covers the root of the hepatic artery; it then turns a little forwards, and rifing fomewhat upwards at the fame time, it paffes under the pylorus, *i. e.* under the ftomach and duodenum; it paffes behind the omentum minus and biliary ducts; it arrives at the porta where the great vena portæ enters the

the liver, and where the great biliary ducts come out ; it paffes betwixt the biliary ducts and the vein ; and having a little before divided into two great branches, thefe now enter into the right and left lobes of the liver. In this place it is inclofed along with all the other veffels in that fheath of cellular fubftance which is called the capfule of Gliffon.

Thus the artery finally terminates near the liver in two great branches, right and left ; but before it does fo, it gives, as it paffes the ftomach, duodenum, pancreas, very important branches to thefe parts. Before it gives thefe more important branches, it gives fmall twigs to the vena portæ and to the head of the pancreas ; then it gives off the great artery which is the fource of thefe leffer arteries (to the pylorus, pancreas, and duo-denum), viz. the ARTERIA DUODENO-GASTRICA, which, foon after it goes off from the hepatic artery, divides into two chief branches. One turns backwards along the duodenum to the ftomach, and from fupplying the ftomach and epiploon, is named GASTRO-EPIPLOIC ARTERY. The other, turning downwards along the duodenum, gives at the fame time arteries to the pan-creas, and fo is named ARTERIA PANCREATICO-DUO-DENALIS. The trunk which divides into thefe two arteries may be defcribed thus : The duodenum begins from the pylorus ; the pancreas pours its liquor into the duodenum ; and therefore the head of the pancreas is attached to the duodenum : this marks the point at which the trunk of the ARTERIA DUODENO-GASTRICA goes off ; for it rifes at right angles from the hepatic ; it lies behind the lower end of the ftomach juft between the pylorus and pancreas ; there it fplits into its two great branches, viz. to the duodenum and to the ftomach. But befides thefe two great branches there are fubordinate arteries, which muft be enumerated together with them.

One artery goes off to the upper and back part of the duodenum over the biliary ducts ; next go off fmall ar-teries to the duodenum of ftill lefs importance, and namelefs ; and at the fame place fmall twigs are often given to the pancreas.

The

The firſt which is diſtinguiſhed or regular, or has a name, is the PYLORICA INFERIOR, the lower pyloric artery. It goes off from the PANCREATICO-DUODENALIS almoſt as ſoon as it touches the duodenum; there are ſometimes two or more pyloric arteries going off at this point; they encircle the pylorus with delicate branches; and at the ſame time turn obliquely upwards, to receive inoſculations from the upper pyloric, which comes from the artery of the ſtomach.

The next artery to be diſtinguiſhed by a peculiar name is one which goes off directly oppoſite to this, belongs to the pancreas, and is named, from its running tranſverſely acroſs the pancreas, the TRANSVERSE PAN-CREATIC ARTERY. It is a neat ſmall branch, which paſſes under the pancreas, runs along its back part, gives its arteries into the ſubſtance of the pancreas from ſide to ſide; and yet is not exhauſted till it has run along more than two-thirds of the length of this long gland.

The next branch is that from which the whole artery has its name: for the artery having given off the lower pyloric artery, and the tranſverſe artery of the duo-denum, turns downwards, bending according to the circle which the duodenum makes, lying in the hollow ſide of that circle juſt as other meſenteric arteries lie along their proper inteſtines. In all this circle it gives continual arteries outwards to the duodenum; it gives alſo frequent arteries inwards to the pancreas. From theſe two connections this branch is peculiarly named ARTERIA PANCREATICO-DUODENALIS. It ends in in-oſculation with the meſenteric artery.

At the place where this pancreatico-duodenalis turns downwards, the other great branch turns backwards and upwards to reach the ſtomach. It is ſo great that it muſt be conſidered as the continuation and ultimate part of the artery. It goes to the ſtomach and epi-ploon, and thence is named gaſtro-epiploic artery.

The courſe of the gaſtro-epiploic artery is along the lower part of the ſtomach, and is moſt beautiful; it makes a broad ſweep round all the greater arch of the
                                                                    ſtomach;

ftomach; it lies in that line where the great omentum comes off from the ftomach; it fends many and large branches upwards upon the ftomach, both on its fore and on its back furfaces; it fends oppofite branches, very frequent and confiderable, down into the web of the omentum or epiploon; it runs along the ftomach till it meets with a fimilar branch from the fplenic artery; and the inofculation between them is fo large and perfect, that we cannot tell where the one artery ends or the other begins. This branch from the hepatic artery is named the right artery of the ftomach, or the right GASTRO-EPIPLOIC ARTERY, while that from the fplenic artery is the left.

Befides this great artery to the duodenum and ftomach, the hepatic artery, before it plunges into the liver, gives another branch, but fmall; it is named pylorica fuperior hepatica.

PYLORICA SUPERIOR HEPATICA.

THE PYLORICA SUPERIOR HEPATICA is fo named to diftinguifh it from that upper pyloric artery which comes down from the ftomach, and fometimes it is called GASTRICA vel CORONARIA MINOR. It comes off from the hepatic artery juft before it divides, or immediately after from the left hepatic. It turns backwards at an acute angle to the leffer arch of the ftomach, and having given fmall twigs to the omentum minus, it goes directly to the pylorus, inofculating with its upper and lower arteries.

HEPATICA SINISTRA.

THE hepatic artery, now advanced to within about two inches of the liver, divides into its two great arteries. Both go to the porta of the liver; but the one belongs to the right lobe, the other belongs to the left. The artery which belongs to the left lobe of the liver is fmaller, and when there is an hepatic artery from the ftomach it is very fmall; it mounts over the vena portæ,

portæ, and enters into the liver at the foſſa umbilicalis ; its branches within the liver go chiefly to the left lobe, lobulùs Spigelii, and anonymous lobe.

HEPATICA DEXTRA.

THE right branch of the hepatic artery paſſes under the biliary ducts, enters along with them into the right lobe of the liver, and before it does ſo it gives off the arteria cyſtica, or artery of the gall-bladder, one of the moſt beautiful little arteries in the body. The cyſtic artery branches over the gall-bladder betwixt its coats, in the form of a coronary artery, and having made a beautiful tree of branches over the gall-bladder, it paſſes off from it, and goes to the ſubſtance of the liver.

ARTERIA SPLENICA.

THE SPLENIC ARTERY is one of the moſt remarkable in the human body. The ſpleen is tied down to the left ſide of the diaphragm by a proper ligament ; it is alſo connected with the greater or bulging end of the ſtomach by proceſſes of the omentum and by veſſels. The ſplenic artery, the largeſt branch of the cœliac, as large as a gooſe-quill, turns off from the cœliac trunk almoſt at right angles, and runs acroſs the abdomen to get to the ſpleen. It is in all this courſe exceedingly tor-tuous ; it runs along the upper edge of the pancreas (which alſo lies acroſs the abdomen), and gives ar-teries to it ; when it approaches the ſpleen, it gives off that great artery which returns along the lower border of the ſtomach, and when it actually arrives at the ſpleen, it divides into a great many branches, which enter by the concave ſurface of the ſpleen, and plunge into its ſubſtance.

The branches then, of the ſplenic artery, are theſe :
1. It gives a great artery to the pancreas named PAN-CREATICA MAGNA, which paſſes to the right under the pancreas, and belongs chiefly to the head of the pan-creas, or that rounded end which is next to the duo-
                                        denum,

denum. Though named magna, it is a variable artery, and of little importance. 2. All along, as the fplenic artery is paffing to the left by the border of the pancreas, it fends fhort branches into it. They are named PANCREATICÆ PARVÆ, or fmall PANCREATIC ARTERIES. 3. It often fends fmall arteries upwards to the back part of the ftomach, named POSTERIOR GASTRIC ARTERIES. 4. The GASTRO-EPIPLOICA SINISTRA, or the left gaftro-epiploic artery, is a very large and principal branch of the fplenic artery. It arifes under the ftomach a little beyond the left or larger head of the pancreas; it makes a large arch, and then turns with a ferpentine turn towards the ftomach, returns along the lower border of the ftomach within the doubling of the omentum, and gives its arteries upwards to the ftomach and downwards upon the omentum, fo much like thofe of the right gaftro-epiploic artery, that when they meet in the middle of the great arch of the ftomach, and inofculate, we cannot diftinguifh where either of them ends; the chief difference is, that fome of the epiploic branches of this artery are particularly large. 5. The VASA BREVIA are a fet of three or four arteries which the fplenic gives off juft before it enters into the fpleen; and as the artery lies clofe to the ftomach, thefe arteries which go to the great bulging of the ftomach are exceedingly fhort, and are thence named vafa brevia. The artery ends by eight or ten branches, which plunge into the fpleen. Sometimes we fee the artery pafs, almoft undivided, or divided into one or two branches only, into the bofom or finus of the fpleen.

These are all the arteries of the ftomach, liver, and fpleen, the vifcera which fill the upper region of the abdomen.

OF

OF THE ARTERIES OF THE INTESTINES.

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OF THE UPPER AND LOWER MESENTERIC ARTERIES.

THE bowels are fo difpofed within the abdomen, that the largeft of them, viz. the colon, the great inteftine, encircles all the others. It begins on the right fide in a blind fac called the caput coli, or head of the colon : it goes upwards, and croffes the belly, fo as to fupport the ftomach, and feparate the ftomach, liver, and fpleen, from the fmall inteftines : it defcends again into the pelvis at the left fide, forming the rectum ; and all the fmall inteftines hang by their mefentery in the central part of the abdomen, furrounded by this great inteftine ; and the arteries lie within the two lamellæ of the mefentery or fupporting membrane of the inteftines, fo that they are called mefenteric arteries ; and they follow the inteftines in the order in which I have named them.

The GREAT or SUPERIOR MESENTERIC ARTERY gives its firft branches to the caput coli ; its next branch to the middle of the colon under the ftomach ; the thoufand turns of the fmall inteftines next abforb all its other branches. The LOWER MESENTERIC ARTERY, which gives no branches to the fmall inteftines, attaches itfelf to the left fide, and efpecially to the loweft part of the colon, and goes down with the rectum into the pelvis, and ends there. This, then, may ferve as a general plan or arrangement for the inteftines and for the two mefenteric arteries.

1. MESENTERICA SUPERIOR.

IT is not furprifing that the UPPER MESENTERIC is the largeft of all the abdominal arteries. It arifes from the aorta, where it is ftill betwixt the legs of the diaphragm,

and

and not more than half an inch below the cœliac artery. The cœliac and mesenteric arteries lie close upon each other ; only we are less sensible of their nearness by the axis cœliacæ jutting perpendicularly forwards, and by the trunk of the mesenteric running very obliquely downwards, and by the head of the pancreas lying immediately over the mesenteric and hiding its root. The trunk of the mesenteric artery passes under the pancreas, then through the mesocolon or mesentery of the colon, then into the proper mesentery of the small intestines. It turns first to the left ; and then, by a second gentle bending, it turns again towards the right side of the abdomen. It runs very low into the abdomen before it gives out any branches ; and then it gives them off in the following order.

From the right side it gives branches to the great intestines, of which there are three chief arteries ; but from the left side, where it gives arteries to the small intestines, it gives innumerable branches, very large, and so inosculated with each other, that they form a sort of mesh or immense plexus in the mesentery before they go onwards to the guts. The undivided trunk of the artery is very large and long ; the gentle curvature of it from left to right gives it the form of an Italic f; the prodigious size of that mesh or plexus of vessels which goes to the great intestines is such as to carry the artery down to the left ilium or flank, where the caput coli or conjunction of the ilium with the colon lies.

It is from the convex of this gently bending arch, and from the right or outer side of the artery, that the following arteries to the great intestines go off [*]. The COLICA MEDIA to the middle of the great intestine, the COLICA DEXTRA to the right side of the great intestine, the ILEO-COLICA to the joining of the ilium with the caput coli or beginning of the great intestine.

[*] Often before giving off its greater arteries, the mesenteric gives to the pancreas several small arteries ; and to the duodenum two or three, which are sometimes named under the title of duodenales inferiores.

COLICA

COLICA MEDIA.

1. THE MIDDLE COLIC ARTERY paſſes along in the doubling, *i. e.* betwixt the two lamellæ of the meſocolon. It goes with a circular ſweep upwards towards that part or corner (as we may call it) of the colon which lurks under the liver ; but before it touches the inteſtine, and generally at the diſtance of about three or four inches from it, this artery divides into two great branches ; one turning backwards, along the right ſide of the colon, inoſculates with the colic arteries ; the other, more like the continued trunk, turns upwards, bending according to the curvature of the arch of the colon, which ſupports the ſtomach ; and having rounded the concave of this arch, and arrived at the left ſide, it there makes a great inoſculation with the left colic artery, which is a chief branch of the lower meſenteric ; and ſo completes the great meſenteric arch, one of the moſt celebrated inoſculations in the whole body, that of the circle of Willis hardly excepted.

COLICA DEXTRA.

2. THE RIGHT COLIC ARTERY is enumerated as a diſtinct artery, chiefly for the ſake of plainneſs ; for though ſometimes it ariſes apart from the general meſenteric trunk, yet in ninety-nine of one hundred bodies it proceeds from the upper or middle colic artery. It is a very large branch ; it is ſet off from the colica media at a very acute angle ; it moves along the right ſide of the colon, inclining alſo a little upwards towards the liver ; it alſo ſplits when it approaches the gut into two branches ; one turning towards the upper ſide to inoſculate with the middle colic artery, the other turning downwards towards the ilium or flank to inoſculate with the ileo-colic artery.

ARTERIA

ARTERIA ILEO-COLICA.

3. THE ILEO-COLIC ARTERY arifes about an inch
lower than the laft. It is a long, fmall, and flender ar-
tery compared with the two laft; which are fhort, ftumpy,
and with contorted angles. This artery goes to the place
where the fmall inteftines end, and the great ones be-
gin; of courfe the membrane which holds the inteftines
at this corner (I mean in the right haunch) changes its
name from MEZZO-COLON (in the middle of the colon) to
mefentery, or MEZZO-ENTERON (in the middle of the
inteftines); and of courfe the ileo-colic artery runs down,
not along the mefocolon, but along the mefentery. It
goes directly down towards the joining of the ilium with
the colon; it ends in three regular branches; one paffes
ftraight onwards to the junction of the ilium and colon,
fplits into two branches, one going over the fore and the
other over the back part of the caput coli, and having a
very curious correfpondence with the valve within, fo
that it might be called ARTERIA VALVULÆ COLI. While
this branch goes ftraight forwards over both fides of the
caput coli, another branch runs backwards along the
colon, and inofculates with the right colic artery; and
another runs downwards along the ilium, and inofcu-
lates with the common branches of the mefenteric ar-
tery. It is from thefe two branches, which diverge like
the reft of the colic arteries, that this is called ILEO-
COLICA. Even the appendix vermiformis has its little
mefentery tying it down to the caput coli, and from the
back of the caput coli a little artery runs down upon
that mefentery to the appendix, paffing along the whole
length of that procefs.

From this point all the remaining arteries of the me-
fenterica fuperior go to the fmall inteftines; and they
are fo undiftinguifhed, and fo prodigioufly numerous,
that no branches can be defcribed or named; there is
nothing but a great net-work of arteries to defcribe. The
firft or radical branches which go to the fmall inteftines,
are thick, large, fhort, and vary from twelve to fifteen

VOL. II.   Q   or

or twenty in number. But it is not thefe that make this vaft appearance of a net-work; thefe twelve branches are firft joined to each other, as it were mouth to mouth, forming one great confluence of arterial arches: from thefe, fecondary branches arife, and they unite again in like manner, and make a fecond row of arches; from the union of thefe ftill other arteries arife, and make a third, or fourth, and even a fifth, row of arches, before any arteries go to the inteftines; till at laft the proper arteries of the inteftines go out in ftraight lines from the laft arch, and fpread upon the coats of the inteftine. In fhort, the mefentery has a very intricated and matted appearance; from the redoubling of thefe arches, which are more and more numerous as the artery proceeds lower, till the laft of the twelve radical branches makes an arch, which ferves the ileon or loweft of the fmall inteftines, and inofculates with the ILEO-COLIC ARTERY.

2. MESENTERICA INFERIOR.

THE LOWER MESENTERIC ARTERY is that which is named by Haller the left colic artery, becaufe it goes only to the left fide of the colon. It arifes from the forepart of the aorta, below the two emulgent arteries, *i. e.* pretty low down. It goes off rather from the left fide of the aorta; it goes off very obliquely, and keeps clofe to the left fide of the aorta for a great way; and when it has defcended as low as the bifurcation of the aorta, it gives off its great branch to the left fide of the colon, viz. the LEFT COLIC ARTERY; and then turning down over the iliac artery of the left fide, it defcends into the pelvis, along with the rectum, and ends there.

1. Its firft branch is the ARTERIA COLICA SINISTRA. The lower mefenteric has run a confiderable length, has paffed as low as the bifurcation of the aorta, before this branch is given off. This artery foon divides into three large branches; the trunk itfelf is fhort and ftumpy, the branches go off like thofe of the other fide, at very acute angles: Firft, One branch afcends towards the angle of the colon, under which the fpleen lies, and there

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there

there divides itself into two branches; one keeping closer to the intestine, nourishes it; the other keeping more to the middle of the mesocolon, or broad membrane of the colon, meets the branch of the upper mesenteric, and completes with it the mesenteric arch, being indeed the larger and more important artery of the two. Secondly, Another branch goes directly across to the right side of the colon, and when it approaches the gut splits (as usual with the colic arteries) into two lesser branches, one turning upwards and the other downwards. Thirdly, The third branch of this left colic artery goes obliquely downwards to that part of the gut which lies in the hollow of the left haunch-bone, and which forms the turn named sigmoid flexure of the colon; and the membrane of the colon is here so fast braced down to the loins that this artery gives twigs to the loins inosculating with the lumbar arteries.

2. ARTERIÆ HÆMORRHOIDALES.

THE INTERNAL HÆMORRHOIDAL ARTERY is one of considerable size; it is just the trunk of the lower mesenteric artery, descending into the pelvis; it is often as large as a writing quill; it applies itself closely to the back part of the rectum; it arrives at it by turning obliquely over the pelvis, and under the rectum, and passes down its whole length quite to the anus. It encircles the rectum completely on each side with its large branches, which meet again upon the fore-part of the gut, and its branches lower down in the pelvis inosculate with the middle hemorrhoidal artery, and sometimes with those of the bladder and womb. This is the artery which prevents us from operating when a fistula in ano has gone deep by the back of the rectum; and which has given occasion to the establishing of something like a general rule in surgery, that one should not operate when the fistula is more than two or three inches deep. It is the last of the arteries belonging to the loose and floating viscera.

Of

228

228228

OF THE REMAINING ARTERIES OF THE ABDOMEN, VIZ. TO THE KIDNIES, TESTICLES, &c.

ARTERIÆ CAPSULARES.

THE capfulæ atrabiliariæ are two fmall bodies of a triangular form, of thick walls and fmall cavities, filled in general with a black and bilious-looking liquor. The ancients thought this the atrabilis, and named them the capfulæ atrabiliariæ: the moderns, from feeing them placed immediately above the kidney, and obferving no apparent connection but with that gland, have named them capfulæ renales. They lie then above the kidney, are like the kidney furrounded with fat, have ftraggling arteries from various fources, but none regular nor important.

Firft, They have very generally fome fmall branches from the phrenic arteries. Thefe are the higheft of the capfular arteries; they touch the uppermoft point of this glandular body. They are named the upper CAPSULAR ARTERIES. Secondly, They often have fmall arteries from the aorta peculiar to themfelves, which come off about the root of the upper mefenteric artery, go to the fat and glands, and play over the vena cava (at leaft thofe of the right fide do), and go to the middle parts of the gland, whence they are named CAPSULARES MEDIÆ. Thirdly, they have their laft arteries fent upwards to them from the emulgent artery, or artery of the kidney. They are named the lower CAPSULAR ARTERIES.

ARTERIÆ RENALES.

THE two RENAL or EMULGENT ARTERIES, the two arteries of the kidneys, go off from the fides of the aorta, midway betwixt the upper and lower mefenteric arteries. Each goes to its kidney almoft at a right angle,

arching

arching a little over the bulging belly of the pſoas muſ-
cle. The aorta is ſtill a little inclined to the left ſide,
and ſo the left emulgent is ſhorter, and mounts over its
accompanying vein; while the right kidney, being fur-
ther off from the aorta, and ſomewhat lower, on ac-
count of the liver being on that ſide, the right artery is
longer, and is covered by its emulgent vein. When the
emulgent artery, which is ſhort and very thick, arrives
at the concave edge of the kidney, it is divided into three
or four large branches, which ſurround the pelvis, or
beginning of the ureter, plunge into the ſubſtance of
the kidney, and inoſculate and make arches with each
other. Then they, in ſupplying the kidney within its
ſubſtance, form circles and arches over the roots of the
papillæ uriniferæ.

Before the emulgent arteries enter into the ſubſtance
of the kidney they uſually give off ſmall arteries, as
has been already mentioned, to the lower part of
the capſulæ renales, to the upper part of the ureters,
and to the fat ſurrounding the kidnies.

ARTERIA SPERMATICA.

THE SPERMATIC ARTERY, or artery of the teſticle,
is one of the moſt ſingular, both for its extreme
ſmallneſs and great length, and for its important
office. It ariſes on each ſide from the lateral parts of
the aorta, a little above the lower meſenteric artery.
The left ſpermatic artery riſes ſomewhat higher, and
often comes from the emulgent artery; it deſcends
from the aorta almoſt in the ſame line with itſelf; it
croſſes the vena cava, and meets its accompanying
vein upon the ſurface of the pſoas muſcle; it then
forms the ſpermatic cord, and paſſes obliquely through
the ſpermatic paſſage and abdominal ring; before it
goes down into the teſticle, it gives out many very ſmall
twigs. Firſt, It gives ſmall twigs to the fat of the kidnies;
ſecondly, It gives ſmall branches to the ureters; thirdly,
Small twigs to the peritoneum; and laſtly, Small twigs to

Q 3 nouriſh

nourifh the fpermatic cord itfelf. When it has paffed through the ring, it foon after divides into many fmall arteries for the feveral parts of the tefticle, four or five in number ; two of which go to the epidydi- mis, and two others, particularly large, go to the tef- ticle ; the largeft of thefe branches turns round the tefticle in a beautiful and ferpentine form, waving along the upper part of the tefticle, viz. juft under the epidydimis, and fending beautiful coronary branches downwards all over the femicircle or convex furface of the teftis.

Thefe are the chief arteries, viz. thofe of the kidney and tefticle. Thofe of the renal capfule I hold to be fo irregular, that they hardly deferve the fhort defcription which I have given of them. The following claffes of fmall and irregular arteries are equally infignificant ; for few authors have been at the pains to enumerate the arteries going to the fat of the kidney ; and none (except Murray) have been at the pains to gather together into one clafs or defcription the trifling arteries of the ureter.

ARTERIÆ ADIPOSÆ.

THE ARTERIES of the FAT of the kidney are ex- tremely fmall but numerous. The upper arteries come from the capfular and diaphragmatic arteries which are above the kidney ; the middle arteries of the fat come from the renal artery itfelf, from the fpermatic, or even from the aorta ; the lower arteries come from the colic arteries, and one from the fpermatic, which comes off below the kidney, and turns up towards its lower end.

ARTERIÆ URETERICÆ.

As the ureter is a long canal, its arteries come off from various parts which it paffes. Its upper arte-
ries

ries are from the renal artery itself, before it enters
the kidney; and also from the capsulars and spermatics.
The middle arteries of the ureter are more particular and
more important: they arise either from the aorta itself,
or from the iliac artery, where the ureter crosses it; and
they run far, both upwards and downwards, along the
canal. The lowest arteries of the ureter arise from
those of the bladder itself.

ARTERIÆ LUMBARES.

THE LUMBER ARTERIES are those which succeed to
the intercostal arteries, and which run parallel with
them; performing the same office in the loins which the
intercostals do in the thorax, viz. nourishing the spine
and the muscles.

The lumbar arteries arise from the sides of the abdo-
minal aorta. The first arteries go off at right angles;
the lower ones are a little inclined downwards. The
right ones are longer, because they have to rise over the
spine. The arteries of both sides, as soon as they have
left the spine, sink under the psoas muscle, and go on-
wards behind it, round the side, till they terminate in
the lateral muscles of the abdomen. The uppermost
lumbar artery is large: and as it runs along the lowest
rib but one, it of course gives arteries both to the trans-
verse or innermost muscle of the belly, and also to the
diaphragm, which indigitates with it in consequence of
their both taking their origin from the same ribs. The
two lower lumbar arteries are small, and begin to in-
osculate with the lesser arteries about the top of the
pelvis.

Each lumbar artery gives out like each intercostal two chief arteries: 1. One which goes to the
spine, and which, splitting into two, gives a larger twig
to the vertebra itself; and a smaller one, which enters
the sheath, lies by the nerve, and passes into the spinal
marrow. 2. A muscular branch, which is also divided;
for one branch of it supplies the psoas muscle, and then

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runs round within the mufcles of the abdomen; while the other pierces the back, and fupplies the facro-lum-balis, longiffimus dorfi, and other mufcles of the loins.

ARTERIES OF THE PELVIS.

The aorta divides into two great arteries, named iliac arteries. The two iliac arteries move down-wards to the brim of the pelvis, where they meet the veins of the lower extremity afcending to form the cava, and alfo a veft plexus of lymphatics from the legs and pelvis, which twift round the arteries and veins. The two iliac veins lie upon the inner fides of the two arteries; and fince thefe veins meet on the right fide of the aorta to form the cava, of courfe the right iliac artery croffes the trunk of the cava. This bifurca-tion of the aorta is much higher than the pelvis; it be-gins upon the fourth vertebra of the loins, fo that the abdominal aorta is in truth extremely fhort, and the iliac arteries go off at fuch an angle, that they diverge very gradually; fo that when they arrive at the top of the pelvis, they are juft over the joining of the haunch-bone with the facrum: and it is but a very little below this again that they divide into their two great branches; the one, named the external iliac, which paffes ftraight forwards into the thigh; the other, the internal iliac, which dives immediately down into the pelvis to fupply the internal parts.

ARTERIA SACRA MEDIA.

The bifurcation of the aorta gives off only one artery, which proceeds exactly from the fork; and being in the middle, it is a fingle or azygous artery, which has not a fellow. It is fmall, long, very regular, and paffes

I   down

down fo correctly in the middle of the bone, that it is named the MIDDLE SACRAL ARTERY. It is about the fize of a crow-quill; paffes directly over the middle of that projecting point which is named the promontory of the facrum; it defcends exprefsly in the middle of the bone, quite to the point of the os coccygis. At the place of each vertebra (for the facrum confifts of ver-tebræ now united together), it gives off crofs branches, which go acrofs the body of the facrum to inofculate with the lateral facral arteries. Befides thefe, it gives arteries to the fubftance of the bone, and not unfre-quently fmall arteries to the rectum. This artery ends near the point of the os coccygis in a forked or double inofculation with the lateral facral arteries of each fide.

ILIACA INTERNA.

THE INTERNAL ILIAC ARTERY is of vaft fize; it not only fupplies all the parts within the pelvis, but fends out by the feveral openings of the pelvis thofe great arteries which fupply both the private parts, and the im-menfe mafs of mufcle which furrounds the haunch. Thence the neceffity and the ufefulnefs of arranging them under two claffes: Firft, Of the leffer arteries which go to parts within the pelvis, as to the loins, to the facrum, to the bladder, and to the womb; and fe-condly, Thofe larger arteries which go out through the feveral openings of the pelvis, the hips, the haunch, and the private parts.

This artery we cannot defcribe in the adult, without attending to its condition and function in the child; for it is that indeed which gives it the peculiar form which we have to defcribe; and which efpecially gives it that arch downwards, from the convexity of which all the great branches go off. For in the child, the internal iliac or hypogaftric artery is extremely large: Firft it turns down into the pelvis with a large circle; then it goes clofe to the fide of the bladder very low into the pelvis; then it begins to rife again by the fide of the bladder, out of the pelvis, and going along by the ura-chus

chus (which is a tube or ligament rather leading up-
wards from the bottom of the bladder), it goes out by
the navel, forming the umbilical artery. Now this fud-
den turn by the fide of the bladder makes the artery
convex downwards, *i. e.* towards the parts which it has
to fupply. The artery keeps this fame form in the adult;
both in the child and in the adult all the great branches
come off from the back of this arch.

ORDER FIRST.

THE branches of the hypogaftric or internal iliac ar-
tery, which remain within the pelvis.

I. ILEO-LUMBALIS.

THIS artery is fo named, becaufe it fo refembles the
lumbar arteries that it might be miftaken for the laft of
them ; and becaufe it belongs equally to the haunch-
bone and to the loins. It goes off from the outer fide
of the iliac artery, about an inch below the bifurcation ;
it is about the fize of the lumbar arteries, or a little lar-
ger ; it turns in behind the iliac artery, and paffes under
the pfoas mufcle ; its trunk is fhort, for it fplits imme-
diately into its iliac and lumbar branches. The lumbar
branch goes off betwixt the laft vertebra of the loins
and the inner end of the ilium, and goes directly up-
wards ; it gives its branches about the pfoas mufcle. The
iliac branch fetting off from the fame point, runs ftraight
outwards, lodges itfelf under the edge or crifta ilii, and
fupplies the iliacus internus mufcle by a fuperficial branch ;
and it nourifhes the bone by a deeper branch, which lies
clofe in the hollow of the haunch.

2. ARTERIÆ SACRÆ LATERALES.

THE LATERAL ARTERIES of the SACRUM are very
generally three or four in number. Sometimes we find
one general artery coming off from the iliac, or from
the

the ileo-lumbar artery, running down all the fide of the facrum, and giving off the lateral facral arteries; but much more frequently we find three diftinct arteries coming off from the fides of the iliac artery, which run acrofs the facrum in the following manner, to inofculate with the middle facral artery: Firft, Each lateral facral artery has one large branch, which runs along the forepart of the facrum, runs along the naked bone, and inofculates with the middle facral artery: Secondly, Another branch, ftill larger, dives into each of the facral holes, which not only nourifhes the nerves, and the fheath of the cauda equina, and the bone itfelf by one branch, but penetrates by another branch through the pofterior facral hole, and fupplies the periofteum, the great ligaments which join the ilium to the facrum, and the root alfo of the facro-lumbalis, and glutæal mufcles. From thefe two branches (viz. to the fpine and to the pofterior mufcles), and from the regularity of thefe five arteries (going from fome artery or other into each facral hole), they refemble the intercoftal and lumbar arteries, to whofe office and place they have fucceeded.

ARTERIA HYPOGASTRICA.

THE HYPOGASTRIC ARTERY is the umbilical artery, of great fize and importance in the child; and even in the adult it ftill remains, in this fenfe at leaft, that though the forepart of it (where it turns up by the fide of the bladder) is clofed, even that part is ftill known by a round ligamentous fubftance, into which it is converted, and which we eafily trace up to the navel, where the artery meets its fellow of the other fide.

This artery is even in the adult body pervious down to the fide of the bladder, where in Man it gives one long and flender artery, fometimes two, which go to the fides of the bladder; and in Women, fmall arteries to the womb, fometimes to the rectum; but thefe branches are quite irregular in number and fize.

ARTERIÆ VESICALES.

THE ARTERIES of the BLADDER are extremely irregular

gular both in number and fize; for it is to be confidered, that the bladder being a round body placed amidft great arteries, and being itfelf membranous, and needing but few or but fmall branches, it gets them from various fources. Very generally the hypogaftric, juft before it clofes into a ligament, fends one or more fmall arteries downwards and forwards to the neck of the bladder, at that part where the veficulæ feminales lie; and of courfe the veficulæ and the proftate gland get fmall twigs from this artery of the bladder; fometimes alfo the bulb of the urethra has a fmall artery from it.

ARTERIÆ HÆMORRHOIDALES.

The arteries of the rectum are all named hæmorrhoidal arteries. The upper hæmorrhoidal artery is the great branch of the lower mefenteric continued to the pelvis. The middle hæmorrhoidal artery is one which fometimes comes from the hypogaftric artery, but very often from the pudic artery, infomuch as to be reckoned among its regular branches. The lower, or the external hæmorrhoidal artery, almoft always is a branch of the pudic artery, or that artery which goes to the penis. Two great arteries, one going to the rectum and another to the womb, are the laft which the hypogaftric gives off before it degenerates into a ligament.

ARTERIA HÆMORRHOIDEA MEDIA.

The middle hæmorrhoidal artery is not a large branch. Often we do not find it, but other arteries fupplying its place; fometimes again it is fo large as to give off both the uterine and the lateral facral arteries; but in general it is fmall. It comes off from the hypogaftric oppofite to the glutæal artery (prefently to be defcribed); it touches the rectum below its middle, and defcends curling and winding chiefly along its forepart quite to the anus; and often it gives, as it runs betwixt the rectum and bladder, arteries to the bladder, proftate gland, and veficulæ feminales. It is this artery alfo which in women gives fmall branches to the vagina.

ARTERIA

ARTERIA UTERINA.

THE womb has four arteries, two from each fide; the uppermoft that which enters by the upper corners of the womb, comes from the aorta, correfponds with the fpermatic in Man, runs along the broad ligament towards the ovaria. The lower artery of the womb, and the largeft, comes from the hypogaftric, enters the womb, where it is connected with the vagina, and runs upwards along the fides of the womb to meet the fpermatic; and it fends alfo at the fame time branches downwards into the vagina, and forwards upon the bladder, where it adheres to this part of the womb.

This uterine artery arifes from the hypogaftric near the origin of the hæmorrhoidal artery, and when it enters the womb it becomes very tortuous.

Thefe, then, are the chief arteries of the rectum, bladder, womb, veficulæ feminales, and other parts within the pelvis.

ORDER SECOND.

OF THE ARTERIES WHICH GO OUT FROM THE PELVIS TO THE HAUNCHES, HIPS, AND PRIVATE PARTS.

IN this fecond clafs or order there are juft four great arteries; one which goes over the back of the haunchbone to the glutæal mufcle, named Glutæal artery; one going downwards over the tuber ifchii to the hip, named the Ifchiadic artery; one which goes out of the pelvis, returns into it again, and paffes out a fecond time by the root of the penis, named the Pudic artery; and one which paffes out through the thyroid hole into the deep mufcles at the top of the thigh, named Obturator artery. All thefe larger arteries go off from the convex of that arch which the hypogaftric forms, and move backwards

wards and downwards, in order to efcape from the pelvis.

Let it be remembered, that the iliac artery forks juft at the meeting of the ilium and facrum ; that the great facro-fciatic notch is formed by this joining of the ilium and facrum, and is juft under the junction of thefe two bones : that the glutæal artery paffes out by this facro-fciatic hole ; and that of courfe it is the firft, as well as the greateft, of thofe three arteries which turn backwards out of the pelvis.

ARTERIA GLUTÆA.

THE GLUTÆAL ARTERY goes off from the internal iliac immediately after the lateral facral arteries. It is exceedingly large, thick, and fhort, within the pelvis, for it immediately turns over the bone ; the turn which it makes over the naked bone is backwards and upwards ; it inftantly divides itfelf into a great lafh of veffels, which fpread in every direction, fupply the two glutæal mufcles, and turn and ramify upon the back of the haunch-bone, juft as the great fcapular arteries play over the furface of the fcapula.

The pyriform mufcle goes out from the pelvis at the fame great opening with the glutæal artery, and the artery is further accompanied by the great fciatic nerve ; the artery and nerve pafs together over the pyriform mufcle, betwixt it and the bone ; and when the glutæal artery is to give out its branches, it fplits into two great branches at the edge of the glutæus medius mufcle. By this fplitting the gluteal artery is arranged thus : Firft, One great branch paffes under the glutæus medius, of confequence it is naked upon the back of the ilium ; it fends one large and beautiful artery, which courfes round the bone according to the line of the crifta ilii, which fupplies all the upper half of the haunch-bone with its nutritious arteries, and fupplies of courfe all the upper half of the great or outermoft glutæal mufcle where it arifes from the fpine and dorfum of the ilium. Another large branch, ftill belonging to this deeper artery, paffes
under

under the thickeft part of the belly of the glutæus medius, lies upon the fmall fan-like mufcle named glutæus minimus, and gives innumerable great branches to the middle and leſſer glutæi mufcles, and to the joint of the thigh-bone.

The other great branch of the glutæal artery flips in betwixt the glutæus major and the glutæus medius ; and as it lies betwixt thefe two great mufcles, it gives a prodigious number of branches to each, but chiefly to the great glutæal mufcle.

ARTERIA ISCHIADICA.

THE SCIATIC ARTERY is fo named, becaufe, inftead of going upwards with this crooked turn towards the haunch, it goes obliquely downwards to the hip, in the direction of the main artery from which it comes. It comes off from the iliac about an inch lower than the glutæal, and is next to it in fize, almoft equal, when (as it often happens) the pudic artery is derived from it. The glutæal artery fhould be contrafted with it thus: The glutæal goes out above the pyrifrom mufcle ; the fciatic goes out below it ; the glutæal turns upwards over the haunch-bone, the fciatic turns downwards along the hip ; the glutæal fpreads its arteries wide with fudden and crooked angles ; the fciatic fends its arteries downwards in a gentle waving form, or almoft ftraight ; and fo numerous as to be compared with a lafh of many thongs proceeding from one fhaft.

Often the glutæal artery, before it paffes out of the pelvis, gives fmall twigs to the rectum, to the bone, and to the pyriform mufcle ; and in like manner the ifchiadic, before it efcapes from the pelvis, gives alfo trivial branches to the rectum, and to the pyramidal mufcle.

The branches of fo great an artery, ramifying merely among mufcles, and among fuch a vaft variety of mufcles, can neither be named, nor are worth naming. All that is to be defired is, to know the trunk, and the general direction in which its greater branches go. Among thefe branches there are few remarkable.

First,

Firſt, The COCCYGEAL ARTERY turns quick back-wards upon the ſciatic ligaments, and lying under the glutæus magnus ; and paſſing along by the direction of the ligament, it ariſes at that part of the ſacrum whence the ligament takes its riſe ; and turning downwards upon the coccyx, and upwards upon the back of the ſacrum it inoſculates with the ſacral arteries through the poſte-rior holes.—Secondly, Another branch, more remark-able for its office than its ſize, runs downwards along the ſciatic nerve, ſupplying its coats and ſubſtance.— But the great branch of this artery ſends a confuſed laſh of arteries downwards, which give arteries, firſt to the glutæal muſcles and pyriformis, and then downwards to all thoſe muſcles of the back of the thigh which ariſe about the knob or tuber of the iſchium. In ſhort, all its chief branches are muſcular ; and the artery is re-markable for no other peculiarity than this, that its inoſ-culations downwards with the reflected arteries of the thigh are ſo frequent, that theſe alone may ſave the limb in wounds of the femoral artery above its profunda, or that great branch which belongs to the thigh.

ARTERIA PUDICA COMMUNIS.

THE COMMON PUDIC ARTERY *, or the artery of the external parts of generation, is the third great artery which goes out from the pelvis backwards. And there is in the courſe of this artery a peculiarity which is never fully explained ; and being unexplained, makes the ſuc-ceeding deſcription quite defective and lame : and it is this. The pudic artery (which is nearly of the ſize of a writing quill) uſually comes off as a branch from the ſciatic artery ; it goes out from the pelvis along with the ſciatic artery through the lower part of the ſciatic notch, under the lower edge of the pyriform muſcle, over the upper ſacroſciatic ligament. But no ſooner has it made its appearance along with the ſciatic artery, and emerged from the pelvis, than it returns into the pelvis again ; it

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* It is named often the circumflex pudic artery, the internal pudic artery, the middle pudic artery, the great pudic artery.

does

does not go over the outfide of the tuber ifchii, and fo down to the perinæum; but it juft appears out of the pelvis, rifes over the upper facro-fciatic ligament, gives out a few branches, turns in again under the lower facro-fciatic ligament, or rather under the fpine or fharp point of the ifchium, whence that ligament arifes: it is now within the pelvis again; it lies flat againft the inner furface of the ifchium; it runs along by the direction of that bone till it approaches the fymphyfis pubis, where the root of the penis is. It there dives into the root of the penis, having juft before given off that branch which goes to the perinæum. It is this long artery, running naked and unprotected along the whole inner fide of the ifchium, bending as the arch of the ifchium and pubis bends, that is cut by ignorant lithotomifts, which a broad gorget is fure to wound, and which can be fafe only by our exchanging the gorget for the knife.

The branches of the pudic artery are chiefly thefe:— Firft, Before it proceeds out of the pelvis, it ufually fends branches inwards to the neck of the bladder, veficulæ feminales, and proftate gland:—Secondly, When it emerges from the pelvis, and while bending over the facro-fciatic ligament, it gives, like the fciatic artery, chiefly mufcular branches; it gives twigs to the facro-fciatic ligament and pyriform mufcle; others go to the gemini mufcles, and turn over them to the great trochanter, and to the hip-joint, reaching as far as the acetabulum; others fpread over the tuber ifchii, to which they give arteries, which go outwards along the three mufcles of the thigh which arife from this point; and it fends inwards from this part an artery which encircles the verge of the anus, and belongs to the fphincter and levator ani mufcles. This branch is named the LOWER or EXTERNAL HÆMORRHOIDAL ARTERY: and other branches it fends forwards into the perinæum; but thefe are fmaller and lefs regular arteries; they are not what are diftinguifhed by the peculiar name of perinæal arteries. This artery, like the ifchiadic, ends every where in inofculations with the reflected arteries of the thigh.

Thirdly, The artery returning again into the pelvis, and running along under the flat internal furface of the

ifchium, gives off many fmall branches to the bladder, proftate gland, veficulæ feminales, and rectum. But when it has reached the perinæum, and is about to emerge from the pelvis a fecond time, and go into the root of the penis, it gives out three chief arteries ; one to the perinæum, one to the body of the penis, one to the back of the penis thus :

When the artery has approached nearly to the muf-culus tranfverfalis perinæi, it fplits into two branches ; one of which is the artery of the perinæum ; the other is the proper artery of the penis.

ARTERIA PERINÆI.

The ARTERY of the PERINÆUM paffes under the tranfverfalis perinæi and betwixt the accelerator and and erector penis ; in fhort, it comes out from that tri-angular cavity which we cut into in lithotomy ; in which operation of courfe this branch cannot efcape. The ar-tery having efcaped from this triangular cavity, runs forwards along the perinæum for two or three inches, according to the fize of the fubject, growing very fen-fibly fmaller as it goes along. It is chiefly for fupplying the fkin and mufcles of the perinæum ; and gives thefe branches : 1. When it has juft come out from the trian-gular hollow, it gives off from its root one branch at right angles, which goes directly acrofs the perinæum ; it keeps the courfe of the tranfverfe mufcle ; it may be named ARTERIA TRANSVERSALIS PERINÆI, and ends about the fphincter ani. 2. It gives branches to the accelerator and erector mufcles. 3. It gives branches to the fcrotum ; and being continued along the corpus cavernofum of each fide, it ends upon the tendinous fheath, which binds the corpora cavernofa. Thus ends the perinæal artery.

ARTERIA PENIS.

The PROPER ARTERY of the PENIS is the continued trunk of the pudic artery. It is much larger than this perinæal branch ; is as big as a crow-quill ; it keeps ftill clofe to the bone, while the perinæal artery goes out-wards ; it at laft touches the fymphyfis pubis, and of

<div align="right">courfe</div>

courfe pierces the corpus cavernofum, juft where it takes its rife from the leg of the pubis : and here it fplits into two great branches ; one to the corpus cavernofum, and one to the back of the penis, or rather into three, fince there is one alfo for the bulb of the urethra.

The bulb of the urethra is quite infulated in the perinæum, while the corpora cavernofa arife from the bone. Now, firft, as the artery of the penis is paffing by the fide of the bulb, it gives off an artery to the bulb fidewife, which in part plunges into the bulbous fubftance, and in part is fcattered upon the accelerator, proftate gland, &c.

Secondly, The artery having rifen to the place where the root of the corpus cavernofum is, gives off that artery, which runs fmall and delicate along all the back of the penis, till it ends at laft in a branch which encircles the corona glandis. This is named the arteria dorfalis penis.

Thirdly, The artery now plunges deep into the proper fubftance of the penis ; the artery of each fide goes into each corpus cavernofum at its root, and fplits into two branches ; thefe run chiefly along the feptum, or partition betwixt the corpora cavernofa of each fide. It is this artery which pours out blood fo freely into the cells of the penis, and caufes erection.

Thefe three, the glutæal, the fciatic, and the pudic arteries, are the only ones which go out from the pelvis behind, and one only goes out by an opening on its forepart or rather its lower part, viz. the obturator artery.

ARTERIA OBTURATORIA.

The obturator artery is fo named from its paffing through the thyroid hole. No artery is lefs regular in its origin ; arifing fometimes from the iliac, fometimes from the hypogaftric, and not unfrequently from the root of the epigaftric artery : in which cafe it turns back again over the pubis, coming into the pelvis through the ring. But no artery is more regular in its deftination ; a confiderable artery always paffes through the thyroid hole, to fupply the mufcles which take their origin from the membrane, and from the ramus of the os pubis.

The

The obturator artery, arifing from the iliac or hypo-gaftric, runs along by the upper edge of the pelvis, by the lower edge of the pfoas mufcle, accompanied with the obturator nerve, which is to go through the hole along with it. Having arrived at the forepart of the pelvis, it flips through the oval hole by a very fmall opening, which is in the upper part of the tendinous membrane, which clofes that hole, and which is confe-quently at the upper edge of the obturator internus muf-cle. The artery, before it paffes out of the pelvis, often gives branches of confiderable fize downwards to the neck of the bladder, proflate gland, and veficulæ; to the iliacus internus and pfoas mufcles, and to the lym-phatic glands which lie upon them; and there is always a branch, which encircles the upper part of the foramen thyroideum, lies clofe upon the bone, and gives its twigs upwards into the mufcles of the belly.

After the artery has paffed along with its nerve through the thyroid hole, it comes into the very heart or central part of the thigh. Almoft all its branches are mufcular; none are worth diftinguifhing by name; it is only the general tendency of the artery that needs to be explained. It divides into two chief branches, taking oppofite di-rections. The firft is deeper; it turns downwards and outwards towards the hip-joint. It performs three fer-vices here; it gives firft arteries to the periofteum, to the capfule, and to the gland within the acetabulum; it gives alfo large branches to the obturator, quadratus fe-moris, and all the great mufcles which immediately fur-round the joint; it alfo forms very large and important anaftomofes round the joint, with the fciatic and pudic arteries from the pelvis, and with the reflected arteries from the thigh.

The more fuperficial branch of the thyroid fends all its branches into the great mufcles upon the inner fide of the thigh coming from the pubis. Its chief branches are to the upper part of the triceps mufcle; it fometimes gives branches even to the fuperficial mufcles, as the gracilis and fartorius; always, at leaft, fmall twigs pafs through thefe mufcles to the fkin of the thigh and to the
fcrotum.

fcrotum.   Of thefe two arteries, this fuperficial one en-
circles the inner edge of the thyroid hole, or that which
is next the pubis, with one of its branches ; while the
deeper artery encircles the outer edge, or that which is
next to the hip-joint ; fo that they meet upon the bone
inofculating with each other.

CHAP. IV.

ARTERIES OF THE LOWER EXTREMITY.

ILIACA EXTERNA.

THE EXTERNAL ILIAC ARTERY is that branch of
the common iliac which defcends under Poupart's
ligament into the thigh.   The internal iliac or artery of
the pelvis parts from this within the pelvis at the joining
of the ilium and facrum.   The external iliac paffes down
into the thigh, by bending along the upper edge or brim
of the pelvis, directed by the lower edge of the pfoas
mufcle, which alfo defcends into the thigh.   This great
artery is accompanied by the anterior crural nerve ; its
correfponding vein lies by the fide of it ; the lymphatics
of the thigh creep upwards along this artery into the pel-
vis ; and when the artery defcends into the thigh, it
paffes fo over the bulging part of the acetabulum and
head of the thigh-bone, that it is felt projecting there
and beating with amazing force.

ARTERIA EPIGASTRICA.

THE EPIGASTRIC ARTERY, fo named from its run-
ning up along the belly, goes off from the inner fide of

R 3   the

the external iliac artery about an inch before it paffes out into the thigh.

The epigaftric, when firft given off, turns downwards with a full round turn till it touches Poupart's ligament. The peculiarity of its courfe here muft be very carefully attended to. The femoral artery lies at the very outer margin * of the opening, called the crural arch. The Fallopian ligament forms the upper line of the crural arch. The epigaftric artery moves inwards and downwards with the Fallopian ligament, running along its lower edge; then it croffes the opening called the abdominal ring, behind the ring, and alfo behind the fpermatic cord which paffes through the ring; then it mounts by the border of the tranfverfe mufcle, and gets to the rectus mufcle of the belly; but it is pretty high before it touches the fide of the rectus, and lying on the outfide of the peritoneum, and on the inner furface of the rectus mufcle, and keeping in the direct line of the rectus mufcle near its centre, or rather nearer the outer edge of the mufcle, and inclining inwards, it mounts from the groin to a little below the borders of the thorax, where it inofculates very freely with the internal mammary artery. Thefe are the inofculations which were mentioned in fpeaking of the internal mammary artery. Through its whole courfe this artery is fo large as to make its wounds important: we fhould know where to ftop it in wounds; we fhould remember to avoid it in opening or extirpating tumours. I have feen fome confufion and much lofs of time during an operation from not attending to this. The main artery muft be remembered; its branches are of little value. The only branches which it is at all neceffary to mention are, firft, one fmall twig, which it fends downwards along the fpermatic cord; foon after entering under the abdominal mufcle, it gives off a large branch almoft equal to the artery itfelf, which goes directly towards the navel, and ends there. This branch goes ob-

* Viz. that end of the flit or arch which is neareft to the haunchbone.

liquely

liquely acrofs the mufcle, while the main artery follows
the general line of the mufcle, and gives branches on
every fide to the rectus, tranfverfalis, obliquus; in fhort
to all the mufcles of the abdomen, and fpreads its laft
branches very freely about the lower border of the cheft.

ARTERIA CIRCUMFLEXA ILEUM.

THE CIRCUMFLEX ARTERY of the HAUNCH is named
CIRCUMFLEXA from its turning directly backwards, and
ILEUM from its paffing along the hollow of the haunch-
bone.

It is fmaller than a crow-quill; it goes off from the
outfide of the external iliac artery oppofite to the epi-
graftic, or rather a little lower; exactly at that point
where the outer end of the Fallopian ligament begins in
the haunch-bone. It runs backwards in a curved line
along the hollow of the haunch bone, curving along
the crifta ilii, or ridge of the ilium, under which
it lies. Its line is along the moft naked part of the bone,
where the internal iliac mufcle begins on one hand, and
the tranfverfe mufcle of the belly on the other: in fhort,
it runs along all the upper edge of the internal iliac muf-
cle, quite round almoft to the lumbar fpine, where it
joins the ileo-lumbar artery by fmall inofculations; for
at this place the reflected iliac artery, which grows gra-
dually and fenfibly fmaller, is almoft fpent. There are
no remarkable branches which deferve to be defcribed
or even to be named, unlefs it be one which goes off
early, near the head of Poupart's ligament, and gives
branches to the ligament, to the fartorius mufcle which
arifes at the fame point of the haunch-bone, and to the
edge of the iliac mufcle. And as it runs along betwixt
the iliac mufcle on the one hand, and the tranfverfe
of the belly on the other, it gives many branches down-
wards to the internal iliac and pfoas mufcles, and to the
fubftance of the bone; and upwards it gives three or
four branches into the abdominal mufcles, which go fo

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far along the belly as to inofculate with all its other
arteries.

THE FEMORAL ARTERY.

The projection of that part of the great artery which
we muſt now call the femoral artery is occaſioned not
merely by the naked pelvis and the head of the femur;
theſe parts are covered by the fleſh and tendons of the
pſoas magnus and iliacus internus, which alſo come out
from the pelvis to the thigh., The artery lies cuſhioned
upon theſe muſcles ; the muſcles dive very deep to get
at the trochanter minor or inner trochanter of the
thigh-bone. The artery follows them ; and thus it is
plunged as it were into a deep cavity, aſſumes a new
poſition, and this conſtitutes a ſecond point of deſcrip-
tion.

The hollow in which the artery now lies may be com-
pared with that of the bend of the arm. The artery
now takes the name of femoral, lies deep in a hollow
ſurrounded by much fat and many glands ; the cavity is
covered with a very ſtrong faſcia, or tendinous ſheath,
which deſcends from the muſcles of the belly over Pou-
part's ligament, and which is greatly ſtrengthened at this
point by the general faſcia of the thigh. Here the fe-
moral artery, inſtead of ſending off leſs effectual
branches from point to point as it moves downwards, and
which could not have conveniently penetrated through
all the thickneſs of the thigh, ſends off one great branch,
which furniſhes all the thigh without exception, whence
it is named the muſcular artery of the thigh. This great
artery goes off from the femoral juſt like the ulnar from
the artery at the bend of the arm, i. e. very deep among
the muſcles, in the triangular cavity above deſcribed.
Thence it is oftener named profunda than muſcular
artery.

The femoral artery having ſent down this great branch,
equal almoſt to itſelf in ſize, inclines outwards again,
meets the inclined line of the ſartorius, and follows its
                                                    oblique

oblique direction, affuming a new character; for now it becomes a fecond time quite fuperficial, is covered by nothing befides the ftrong fafcia of the thigh and by the fkin. It is felt beating along the line of the fartorius mufcle; and by that line we apply the cufhion of our tourniquet. It retires from our feeling only about two hands breadth, or a little more, above the joint of the knee; at which place it perforates the triceps or great mufcle of the thigh, gets from the fore to the back part, or, in other words, forfakes the thigh to go down behind into the ham, where it exchanges its name for that of popliteal artery.

The popliteal artery, when it has got into the ham, meets with its correfponding nerve, which is of vaft fize; and the artery lies now flat upon the back part of the thigh-bone, paffes down in a hollow formed betwixt its great condyles, lies flat upon all the back of the knee-joint, is enclofed by the two great hamftring mufcles from above, and by the two great heads of the gaftroc-nemii mufcles below. But although we fay it is pro-tected, yet in truth it is not tightly bound down by a fafcia embracing it, but lies on the contrary fo loofe and unfupported among the cellular fubftance, that we have the moft certain evidence of its being often racked and ftrained in fudden or awkward motions of the joint.

From the ham the artery defcends into the leg, un-der the heads of the gaftrocnemii mufcles; and being lodged behind the great bulging, or head of the tibia, below the joint, it there divides into three great arteries. One paffing down behind the tibia is named pofterior tibial artery; one perforating the interoffeous membrane goes down along the forepart of the tibia, is named tibi-alis antica; the third artery, paffing down behind the fibula, is named the fibular or peronæal artery. Thefe may be juftly compared with the three arteries of the fore-arm; and as thofe meet in arches upon the palm of the hand, thefe meet and form fimilar arches on the fole of the foot.

Even from this flight and general defcription of this important artery, many conclufions may be deduced not
<div align="right">indifferent</div>

indifferent to the furgeon ; for there are feveral points in the courfe of this artery very peculiarly marked.

Firft, It is thrown fo forwards by the bulging of the pubis, where it forms the focket for the thigh-bone, it beats fo ftrongly juft under the rim of the belly, that we cannot, at leaft till we try, doubt of its being eafily compreffed. I fee, indeed, that Acrel, in very defperate circumftances, when his ligatures had given way even before his eyes, and the arteries burft, and after the furgeons had been twice deluged with the blood of the femoral artery, thought that he had fuppreffed this artery, by refting on it with his thumbs. But indeed the poor patient, under thefe horrible circumftances, as Acrel juftly calls them, muft have fallen fo faint and low, by a tedious alarming operation, and by the repeated bleedings, that any thing might have fuppreffed the pulfe in the femoral artery, when that of the heart itfelf was well nigh gone *. But this is one of the points in which it is the moft neceffary for every man to fpeak from his own experience. I have tried it in the moft favourable circumftances in a flender young man ; and when I thought myfelf fure of the point, behold the blood gufhed out with a whizzing noife and prodigious force. I have feen others try it, and fail. It is perhaps not impoffible to comprefs the femoral artery ; but it is not an eafy thing, and is an expedient never to be trufted where the life of a fellow-creature is immediately in danger.—Secondly, The ftrong covering of the fafcia gives a peculiar form to the aneurifm of the thigh ; it keeps it flat, forces the blood to fpread abroad into the furrounding parts ; and this deep driving of the blood among the mufcles, together with the great fize of the fac, and the putrefaction of three or four pounds of blood, caufes that gangrenous and floughing condition of the parts, by which we are fo often foiled in our beft concerted operations, and after the artery has

* " His in horrendis anguftiis, cum nec nova ligatura, nec torcularis contractione hæmorrhagia fifti poffet, in trunco ipfo, dum ex inguine prolabitur, pollicibus firmiter admotis, compreffionem inftituere placuit, quo effluxus fubftitit."

been

been well and fairly tied.—Thirdly, It is very obvious
that the profunda might with more propriety be named
the femoral artery, fince it is the proper artery of the
thigh ; and though Heifter, and fome of the beft among
the old furgeons, fpoke of this divifion as one which
only fometimes took place, we know that a leg could
no more be without a profunda than without what we
call the femoral artery ; and we alfo perceive, notwith-
ftanding the doubts and fears of fome modern furgeons,
that when the femoral artery is wounded, it is after all
only a wound of the artery of the leg.——Fourthly,
The large branches which the profunda fends upwards
round the haunch, inofculating with the fciatic and pudic
arteries, and the branches which it fends downwards to
the knee, inofculating round that joint with the arteries
of the leg, make this branch of peculiar importance to
the furgeon ; for when the artery is wounded in the
groin, above the profunda, this branch faves the thigh,
by its inofculations round the haunch ; and when the
artery is wounded in the thigh, below the profunda, or
in the ham, it faves the leg by its inofculations round
the knee ; and when the whole line of the femoral artery
has been obliterated, it has faved the whole extremity,
as I have elfewhere proved, by receiving the blood from
the arteries round the haunch, and conveying it down to
the arteries below the knee, being thus an intermedium
betwixt the internal iliac artery and the arteries of the
leg, capable of forming a new line of circulation be-
hind the thigh when that before is fhut up. Nor fhould
it be forgotten, that the aneurifm on the forepart of the
thigh may be from the profunda ; and then the femoral
artery which lies before it may be cut acrofs by a rafh or
ignorant furgeon.

Fifthly, The place of the femoral artery paffing
through the triceps mufcle is next to be obferved, for
thefe reafons. At that point it lies clofe upon the bone ;
and as this happens exactly at that diftance above the
knee at which we ufually amputate, we expect in fuch
amputations to find the great artery clofe by the bone.
As the artery is at this point tied down by the tendon of
<div align="right">the</div>

the triceps, and is in fact paffing through a tendinous
ring, it fometimes happens that when we have cut near
this, but not upon it, the flefh fhrinks in fuch a way
that even this great artery, though it bleeds, is not
eafily found ; but one ftroke of the fcalpel, running
along the bone, cuts the tendon up, and expofes the
artery with open mouth.———This fingle point makes all
the difference betwixt an aneurifm of the thigh and of
the ham ; it is peculiarly neceffary to mark this, in
order to afcertain the extent of the difeafe before begin-
ning an operation. Nothing can have a worfe appear-
ance than that which has actually happened, viz. a fur-
geon beginning that operation in the ham, which he
fhould have attempted rather on the fore-part of the
thigh ; and being forced to change his ground, and to
begin a fecond operation on the fore-part of the thigh,
or, what is worfe, to cut up the tendon, and follow the
difeafed artery to the fore-part of the thigh, cutting, in
fhort, firft longitudinally betwixt the hamftrings, and,
after an hour's working perhaps, cutting crofs-wife to
reach the fore-part of the thigh.

6thly, Is it not a matter of very high importance to
ftudy the ham ftill more carefully than the axilla, fince
the artery is fo often hurt at this place by rude motions
of the joint ? For it is a narrow cavity ; the artery lies
clofe upon the joint and bones ; and when it is allowed
to remain long in a difeafed ftate, enlarging and dilat-
ing the ham, we perform in the end a hopelefs opera-
tion ; or, if we had hopes when we began our opera-
tion, they are all over before it is ended : for the parts
are found to be difeafed, the bones carious, the joint
fpoiled ; there is no hopes even of prefent fafety, and
of the ligature holding, and much lefs any expectation
of a permanent cure. Often the greateft furgeons have
been contented to finifh fuch an operation by cutting
off the limb !

7thly, When the artery has gone down beyond the
ham, and feems lodged fafely under the gaftrocnemii
mufcles, ftill it is not fafe ; it is bended tenfe over the
back of the joint ; it is preffed by the gaftrocnemii
                                        ftretching

ſtretching over it ; and their violent action has often been ſuch, as to have torn the artery with a tumour ſo immediate, and with ſuch excruciating pain, that the ſurgeon has been conſtrained in a manner to cut off the limb even upon the ſpot.

8thly, Very often we are obliged to decide, whether a tumour of the thigh or a tumour of the ham can be cut away only by our knowledge of theſe arteries. How often the anterior arteries of the leg are cut by workmen, and how much they are expoſed to the ſtroke of the adze or axe, every practical ſurgeon muſt know : but the miſchances that open arteries are quite unthought of. I have known a man ſtanding careleſsly by his ſcythe, which was ſet upright, the blade along the ground, and the ſhaft reſting upon his arm, cut the artery behind the outer ankle ſo as to form (when the wound healed) a large, livid, and ſtrong beating aneuriſm, ready to burſt, and requiring immediate operation.

The epigaſtric artery is in danger in operations for hernia. The femoral artery is the ſubject of frequent operations ; the popliteal aneuriſm is a diſeaſe of this artery in the ham ; and even the ſimple operation of amputating either the limb, itſelf, or tumours in the thigh or ham, requires a perfect knowledge of all theſe arteries.

But although no formal operation affected theſe leſſer arteries, yet the main artery itſelf is ſo expoſed, and ſo ſuperficial where it runs down the thigh, that it is wounded in a hundred various ways. It is very ſingular how often it has been wounded by one particular accident, viz. the dropping of a pair of ſciſſars, and with a ſudden inſtinctive effort clapping the knees together to catch them. It has been wounded once or twice by a ſhoemaker clapping his knees thus together to catch his ſharp-pointed paring-knife. One of my pupils lay three months in London, uncertain whether his femoral artery was wounded ; for he had in this way catched his pen-knife, the point of which had run into his thigh, and wounded ſome great artery. It has been cut acroſs by balls ; it has been wounded even by a ſingle ſlug ; it has

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been uncovered by wounds which yet did not touch its coats, and has in confequence dilated into an aneurifm. I have known a boy ftab another with a pen-knife in the thigh, and ftrike fo critically as to open the artery with a wound like that of a lancet. My friend Mr. Harknefs gave me the privilege of diffecting an aneurifmal limb which he was obliged to cut off; and in which the artery was (if I may ufe fuch an expreffion) broken or torn acrofs the upper end of the thigh-bone, which had been broken by a fall about three weeks before.

All thefe accidents muft come upon the furgeon very fuddenly; and if they come upon him unprepared, all is in a moment loft. I once faw a fine young fellow die from this alarm of the attendants and confufion of the furgeon. He was a tall, ftout, young man, who was fitting at table with his companions eating bread and cheefe, taking his glafs, and telling his tale. He had in his hand a fharp-pointed table knife, which he happened to hold dagger-wife in his hand, and in the height of fome affertion or oath he meant to ftrike the table, but the point miffed, and flanted over the table; he had ftabbed himfelf in the femoral artery, and with one gufh of blood he fell to the ground. When I came, I found the young man ftretched out upon the floor; he was juft uttering his laft groan; the floor was deluged, all flippery, and fwimming with blood. The wound was covered with a confufed bundle of clothes, which I inftantly whirled off; and in that moment two gentlemen, who had been firft called, and who had both run off for tourniquets (becaufe tourniquets are ufed to ftop bleedings), returned; and had the unhappinefs to fee that the hole was no bigger than what I could clofe, and had actually fhut up with the point of my thumb; and which, had it been fhut and put together with a good comprefs, would have healed in three days, forming a large beating aneurifm within, allowing time for a deliberate operation.

In fhort, to enumerate the variety of accidents which may affect this artery would be impoffible; but furely from the little that I dare venture to fay in this place, it

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muſt ſeem one of the largeſt, the moſt expofed, and moſt dangerous, and by all this the moſt important, artery in the body ; and from thefe previous hints and general defcriptions, the value of the feveral branches which are now to be enumerated will be more eafily felt and underſtood.

BRANCHES OF THE FEMORAL ARTERY.

THE femoral artery, until it gets down into the hollow which I have defcribed, gives no branches, or none with which I would choofe to confound the defcription of the profunda or great artery of the thigh. The branches which the femoral gives off before that are only fmall twigs to the fat, glands, fkin, or private parts ; but one or two of thofe to the private parts are fometimes large.—Firſt, Twigs go out along the femoral ligament, and terminate in the fkin.—Secondly, Twigs go to the fat, and lymphatic glands of the groin.—Thirdly, There afcends a fmall branch, fometimes towards the origin of the fartorius, to the middle glutæal mufcles, and to the beginning of the fafcia lata.—Fourthly, Of thofe branches which go acrofs the upper part of the thigh to the genitals, and which are named PUDICÆ EXTERNÆ to diftinguifh their branches from thofe of the pudica communis, there are ufually three. The uppermoſt is fcattered about the fat of the pubis. The middle one goes acrofs the heads of the triceps ; it is longer and larger than the others ; it goes to the fide of the fcrotum and penis in Men ; in Women it is large, and runs into the labium pudendi. The lower one of the three goes to the lower parts of the fcrotum, and to the fkin of the thigh near it.

ARTERIA PROFUNDA FEMORIS.

THEN comes off the profunda femoris, the DEEP or MUSCULAR ARTERY of the THIGH. It arifes from the femoral artery about four inches below the groin, more or lefs according to the fize of the fubject. It turns

off

off from the femoral artery with a bulging, which looks backwards and towards the outfide of the thigh. It lies deep in the triangular cavity, upon the face of the iliacus internus and pectinalis mufcles. It prefently gives off two great arteries, which turn upwards along the joint; one round the outer fide, the other round the inner fide, of the joint. Then it paffes downwards, turns in behind the femoral artery, finking deeper and deeper towards the back parts of the thigh. It paffes down along the face of the triceps mufcle; and as it moves along its fore-part, it fends through three or four great arteries to the back part, which are called the perforating arteries of the thigh. And, laftly, the profunda itfelf, or its laft branch, paffes through the triceps; and this laft branch is named perforans ultima vel defcendens femoris.

ARTERIA CIRCUMFLEXA EXTERNA.

The circumflex atery, which goes to the out-fide of the hip-joint, proceeds from the very higheft point of the profunda. It takes its courfe outwards, paffing under the fartorius, fafcialis, and head of the rectus: it runs over the tendinous head of the vaftus in-ternus, where that mufcle takes its rife from the outer trochanter: it divides very early into the following branches.—Firft, Branches go to the inner fide, to the internal iliac mufcle, upon which this artery lies; and round it they bend over the leffer trochanter, making inofculations with the internal circumflex artery.—Secondly, An artery goes in the oppofite direction, viz. outwards, to the iliac mufcle, the fartorius, the head of the rectus, the fafcialis, and round to the glutæal muf-cles.—Thirdly, It fends many leffer branches upwards and forwards into the heads of thofe mufcles which I have juft enumerated, and which lie immediately over the artery.—Fourthly, It fends large branches round the root of the great trochanter, fome of them going into the hollow above the trochanter; others keeping fo low as the root of the trochanter, where the greater glutæus

is

is inferted.—Fifthly, The moft important of all its branches is a very long one, which it fends directly downwards under the rectus, or betwixt it and the vaftus internus mufcle. This artery is divided into two great branches, which run down the whole length of the thigh, fomewhat refembling in their fhape the PROFUNDA HUMERI: they are named the greater and leffer defcending branches of the circumflex artery, and they inofculate in a moft particular manner with a large anaftomofing branch from the femoral artery. The larger branch of this artery emerges from betwixt the rectus and vaftus externus, a little above the knee, to inofculate with one of the articular arteries of the knee. Its fmalleft branch inofculates with the anaftomofing branch of the femoral artery. Thefe two anaftomofes feem to be the chief ufe of thefe two long arteries, though they do alfo fend fome branches to the mufcles.

But to give a more fimple notion of this circumflex artery, it fhould be defcribed thus. It is divided into three chief branches: 1ft, A defcending branch, which goes down to the knee-joint; 2d, A tranfverfe branch, which croffes the upper part of the thigh, and turns round the neck of the thigh-bone; 3dly, It fends a lefs important branch up upon the dorfum ilii.

ARTERIA CIRCUMFLEXA INTERNA.

THE INTERNAL CIRCUMFLEX ARTERY is a thick fhort artery, which goes off oppofite to the ball of the thigh-bone; and as the external one goes round the great trochanter, this goes round the leffer trochanter. It is a fmaller artery; it has not fo many mufcular branches; it keeps clofer to the joint; it goes off from the inner fide of the profunda, juft oppofite to the circumflexa externa, or a little lower, but never more than an inch lower; it paffes over the infertion of the pfoas mufcle, and under the belly of the pectinalis; it attaches itfelf then to the leffer or inner trochanter, and goes round the neck of the thigh-bone round the joint, and

is expended on the mufcles at the back of the joint, as
the quadratus femoris, gemini, &c.

The artery having turned towards the infide, the muf-
cles which lie there are the triceps gracilis, &c. The
firft branches, therefore, which this artery gives off be-
fore it paffes under the pectinalis, are to the triceps and
gracilis. After having paffed under the pectinalis, and
while it is turning round the root of the leffer trochan-
ter, it gives branches to the pectinalis and triceps;
and efpecially it gives to the capfular ligament of
the hip joint an artery which is named articularis
acetabuli.

The artery now lying upon the pelvis, under the neck
of the thigh-bone, divides itfelf into two chief arteries;
one goes upwards and forwards along the triceps, till it
ends at laft round the fymphyfis pubis. The chief muf-
cular twigs of this branch are given to the triceps, and
to the obturator mufcles; it is this branch which inof-
culates fo freely with the branches of the obturator ar-
tery; it is a twig of this artery which enters into the
cavity of the hip-joint, by that breach which is in the
inner edge of the acetabulum; and this branch entering
then by its proper hole, goes to the gland in the bottom
of the focket, or chiefly to it. The other branch turns
away in the oppofite direction, viz. backwards betwixt
the little and the great trochanter, turning round the
neck of the thigh-bone. It gives branches alfo to the
triceps and obturator, inofculating with the obturator
artery. But its chief branches are towards the other
fide, as to the capfule of the hip-joint, to the neck of
the thigh-bone, to the quadratus femoris. It is this
artery which gives moft of thofe branches about the
roots of the trochanters named trochanteric arteries;
and it is from this artery that many branches go back-
wards along the tuber ifchii, to unite with thofe of the
fciatic and pudic arteries.

OF THE PERFORATING ARTERIES.

The two firſt perforating arteries are very large ; the two next perforating arteries are ſmaller and leſs regular ; the fifth perforating artery is juſt the termination of the profunda. But ſtill it muſt be underſtood, that theſe perforating arteries are extremely irregular in place, ſize, and number, as indeed all muſcular arteries muſt be ; and that there are, beſides the greater perforating arteries, many like them in this part of the thigh, though not diſtinguiſhed by name.

ARTERIA PERFORANS PRIMA.

The first perforating artery is the largeſt branch of the profunda, bigger than both the articular arteries joined. It ariſes from the profunda, juſt under the leſſer trochanter, betwixt the pectinalis and triceps brevis ; and perforates the triceps about an inch below the trochanter, and cloſe upon the thigh-bone. Here the artery lies under the lower edge of the glutæus, and cloſe by the origin of the biceps, ſemi-tendinoſus and ſemi-membranoſus muſcles, the three muſcles which form the hamſtrings ; and the chief diviſion of the artery is into one great branch, going upwards along the glutæus, and another going downwards along the flexor muſcles. Firſt, The artery which goes upwards turns over the glutæus, ſpreads innumerable branches about the great trochanter ; and meeting with the trochanteric branches of the arteriæ reflexæ, make a moſt beautiful inoſculation, or rather net-work of inoſculations, over the trochanter. Another tranſverſe branch of this upper artery turns quite round the lower part of the trochanter, and round the thigh, among the fleſh of the vaſtus internus ; and a third branch of the ſame artery meets in inoſculation with the lower branches of the ſciatic artery.

The lower or deſcending branch of the perforans prima goes down along the three flexor muſcles of the leg, viz. the biceps, ſemi-tendinoſus, and ſemi-mem-

S 2   branoſus ;

branofus; nourifhes their flefhy bellies, and plays over their furface in beautiful net-work.

ARTERIA PERFORANS SECUNDA MAGNA.

THE SECOND or GREAT PERFORATING ARTERY is a much larger and more important branch of the profunda than this firft, at leaft it is fo when the other perforating branches are wanting, and when this, as often happens, reprefents the continued trunk of the artery : but I fhall defcribe it as a fecond perforating artery, to be fucceeded by others *. The fecond perforating artery comes off from the profunda, about two inches lower than the firft ; it paffes through betwixt the firft and fecond heads of the triceps, or through the flefh of the fecond; and turning obliquely downwards and backwards, clofe by the thigh-bone, it paffes into the cellular interftice betwixt the flexor mufcles of the oppofite fides, i. e. betwixt the bellies of the hamftring mufcles, and ends there.

Before it paffes through the triceps, it gives branches to the triceps and vaftus, and to the great trochanter, and to the thigh-bone. Its two chief branches, after it perforates the triceps, are, firft, one great tranfverfe branch, which goes directly acrofs below the tendon of the glutæus, and gives one great branch up upon the glutæus, and another to the vaftus externus, making inofculations with the reflected arteries of the joint. Secondly, Its defcending branch goes down in the hollow betwixt the great hamftring mufcles, and its branches go into both mufcles, but chiefly into the biceps, and in thefe the artery is exhaufted.

ARTERIA PERFORANS TERTIA.

THE THIRD PERFORATING ARTERY comes off about a finger's breadth lower than the former ; it makes a

* My reafon for faying this is, that fometimes there are but two perforating arteries, while there are often five which need to be defcribed.

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gentle waving turn inwards before it pierces the triceps;
and after having perforated the triceps, it gives its bran-
ches to both the hamftring mufcles, but chiefly to the
femi-tendinofus.

ARTERIA PERFORANS QUARTA.

THE FOURTH PERFORATING ARTERY may be re-
garded as the laft, or as the termination of the pro-
funda, though fometimes there is a fifth. It perforates
again ftill lower, about a finger's breadth below the
laft, through the flefh of the triceps magnus. Its firft
branch, while on the fore-part of the triceps, is the nu-
tritia magna femoris, or proper nutritious artery of the
thigh bone; and after it perforates the triceps, it gives
its arteries to the two hamftring mufcles, but more
efpecially to the biceps; and fo this laft branch of the
profunda ends.

But this minute defcription of any important fet of
arteries never prefents any clear idea to the reader's
mind, nor any knowledge which he can eafily retain, I
expect rather to do fo by one fhort defcription.

The title of PERFORATING ARTERIES is one which
comprehends all the great mufcular branches of the
profunda, except the two reflex arteries belonging to the
joint. They vary in number, as all mufcular branches
muft do, and are proportioned in fize and number to
the bulk of the thigh. The profunda paffes down along
the fore-part of the triceps, while it is giving off thefe
arteries; they muft, of courfe, perforate the triceps be-
fore they can get to the back part of the thigh. When
they do perforate, they come into a great mufcular
interftice or hollow, which is formed by the hamftring
mufcles of oppofite fides, by the biceps on one fide, and
by the femi-membranofus and femi-tendinofus on the
other. It is to thefe two great mufcles of the back
part of the thigh that the branches of all the perforating
arteries are chiefly directed. Each perforating artery
fucceeds another at about the diftance of an inch or
more; each fucceffively coming out into this interftice

S 3

at

at a lower and lower point. Each artery gives branches
to the triceps, &c before it perforates, and to the ham-
string muscles, &c. after it has come into the hollow.
The two first perforating arteries are the only arteries
which are large and absolutely certain; the third is
always very much smaller; the fourth is generally the
termination of this great artery; the fifth perforating
artery is rare.

Such a general idea as this of their size and value,
and situation in the very heart or deepest part of the
thigh (for the profunda turns backwards from the very
first, and all its branches keep the same direction), is
of more importance than a particular knowledge of
every branch of each perforating artery; a thing really
unattainable, since they vary more in their ultimate
branches than almost any other arteries in the whole
body; for they have more space, and a greater mass of
irregular muscle to wander in, and produce varieties.

ARTERIA FEMORALIS.

THOUGH the profunda is plainly the artery of the
thigh, yet from the ignorance of anatomists and sur-
geons (who never knew till about twenty years ago that
there was more than one great artery) the superficial
artery has been named the artery of the thigh.

The femoral artery makes a spiral or serpentine turn
round the whole thigh. It appears first on the fore-
part; it turns obliquely round to the inner side, fol-
lowing the lower edge of the sartorius muscle; it
passes through the triceps, after it has got about two-
thirds down the thigh, by which it gets into the ham,
and its spiral turn is completed. It lies deep where it is
giving off the profunda; it rises then, and is superfi-
cial all along the middle of the thigh; and when it has
advanced two-thirds down the thigh, it again gets too
deep to be felt; but all along it is covered by the thick
strong fascia of the thigh. Through the whole of
this course it gives no one branch out that is of any
considerable importance. They are all muscular arte-
ries.

ries, very fmall, nearly of one fize, namelefs, and un-
diftinguifhed, going into the mufcles of the fore part of
the thigh ; or if any are diftinguifhed, it is only by
their relation to other arteries, when the trunk gets
low enough to make anaftomofes with the arteries of the
joint.

The namelefs mufcular branches of the Femoral ar-
tery go, in one word, to all the mufcles on the fore-
part of the thigh ; to the rectus, fartorius, vafti, gra-
cilis, and triceps ; to the glands, fafcia, fat, and fkin ;
and it thus continues giving fucceffive branches to each
of thefe long mufcles as it paffes the feveral points
of them.

There is no diftinguifhed branch till, having arrived
within two hands' breadth of the knee-joint, it gives out
(juft where it is about to pafs through the tendon of the
triceps) a larger branch named (like a fimilar branch of
the humeral artery) RAMUS ANASTOMOTICUS MAGNUS.

This branch goes out from the inner fide of the fe-
moral artery juft where it is about to perforate the tri-
ceps ; it paffes into the flefh of the vaftus internus ; it
firft fends fmaller branches to the vaftus internus and
fartorius, and through the interftice of thefe two
mufcles to the fkin of the knee. But having pene-
trated into the flefhy belly of the vaftus internus, this
artery, which is itfelf very fhort and thick, fends out its
flender inofculating branches : one goes downwards
along the tendon of the great triceps ; and when the
tendon of that mufcle ftops above the inner condyle,
this artery goes forwards over the condyle, makes a
net-work upon it, joining in numberlefs inofculations
with the articular arteries from below, and gives twigs
alfo into the joint. The other branches of this ramus
anaftomoticus tend all forwards and upwards to join
the defcending branches of the reflexa externa, which
come down along the rectus mufcle.

There are two other arteries lying clofe upon the
joint, remarkable enough to deferve a name, and they
are called perforating arteries ; not perforating like the
branches of the profunda, to get deeper among the flefh ;

S 4   but

but perforating fo as to get out from the cavity of the ham upon the furface of the thigh again.

The UPPER PERFORATING ARTERY arifes from the inner fide of the popliteal artery, juft after it has perforated the triceps; but it muft not be accounted a popliteal branch, becaufe it immediately perforates the triceps mufcle again. It gives branches to the femi-tendinofus, femi-membranofus, and fartorius; in fhort, it turns its branches towards the mufcles on the inner fide of the knee, and is a fmaller artery.

The LOWER or SECOND PERFORATING ARTERY goes off nearly oppofite to this. It is a much larger artery. In order to efcape from the ham, it perforates the fhorter head of the biceps, or outer hamftring mufcles. It firft croffes the ham at its very upper point, and within the fubftance of the triceps; it then perforates the fhorter head of the biceps flexor-cruris; it then emerges upon the thigh by the belly of the vaftus externus mufcle. Before it paffes acrofs the ham, it gives a branch to the femi-membranofus; while it is paffing through the flefh of the biceps, it gives a lower nutritious artery to the lower and back part of the thighbone; after it perforates the biceps all its branches are to the flefh of the biceps and vaftus externus, and its extreme branches are fpent in inofculations with the defcending branch of the reflex or articular artery of the hip-joint.

But thefe branches, which are the laft of the femoral artery, are extremely irregular. There is no artery from the profunda downwards worth naming, not even thofe which I have juft defcribed *.

* " Confiteri tamen oportet, binos ultimos ramos in diftribuendis fuis furculis infinite ludere, ita ut defcriptione ad quodcunque cadaver adaptata vix, ac ne vix quidem comprehendi poffint. Ex repetitis tamen meis diffectionibus id pro certe habeo, duos vel tres, quos perforantes appellare vellem, exoriri, hos trunculis fuis ad externum latus præcipue conflecti cumque rete vafculofo genu jungi, nutritiant inferiorem ex iifdem gigni, et ramos infuper, nunc pauciores, nunc numerofiores, communicantes ad flexores cum profunda clevari." *Arvidfon,* p. 36.

POPLITEAL ARTERY.

THE artery having paſſed through the ring or tendon of the triceps which is formed for it, or rather having paſſed betwixt the triceps and the bone, lies flat againſt the flat part of the thigh-bone as deep as poſſible in the cavity of the ham. There, as no muſcles are lodged, it can give no muſcular arteries of any importance ; none but trivial ones to the hamſtrings or to the heads of the gaſtrocnemii. In its whole length from the place of its perforating the triceps tendon to its great diviſion, which is under the longer head of the folæus muſcle, it gives none but articular arteries, *i. e.* ſmall arteries to the knee-joint, which are no leſs than five in number, and encircle it in all directions.

Firſt, the popliteal artery ſends off from each ſide two muſcular branches, not deſerving a particular name nor deſcription ; the one goes to the biceps or muſcle of the outer hamſtring, the other to the femi-tendinoſus and ſartorius, or inner hamſtring muſcles.

Then come off the arteries of the joint, which are thus arranged : 1. The upper arteries coming off above the joint are three in number ; one turning round the inner ſide of the joint, and one round the outer ſide, and one in the middle ; whence it is named azygous, as having no fellow. 2. The arteries below the joint are two only in number ; one to the inner ſide, and one to the outer ſide, of the joint ; and theſe directions of the arteries ſettle both the order of deſcription and alſo their names.

ARTERIA ARTICULARIS SUPERIOR EXTERNA.

THAT upper articular artery which comes off above the knee, and which turns round the outer ſide of the joint, ariſes from the popliteal artery above the outer condyle ; its trunk is like all theſe arteries about the joints, ſhort and ſtumpy ; but its branches long and ſlender. It paſſes under the fleſh of the biceps ; it appears again at the edge of the vaſtus externus : one

branch

branch plunges into the vaſtus externus, mounts up-
wards, and, beſides ſupplying the muſcle, inoſculates
with the long deſcending branch of the reflexa externa ;
while another branch turns as directly downwards over
the face of the outer condyle, and ſpreads beautifully
over the ſide of the joint, inoſculating in many net-works
with the correſponding artery from below.

ARTERIA ARTICULARIS SUPERIOR INTERNA.

THE UPPER ARTICULAR ARTERY of the INNER
ſide goes off in like manner over the inner condyle,
pierces the tendon of the triceps, where it is implanted
into the condyle, and paſſing under the edge of the
vaſtus internus, turns towards the fore-part of the knee,
proceeds towards the patella, and covers chiefly the
inner ſide of the joint with its net-work of inoſculations ;
its little twigs ſlip in under the great lateral ligament,
and under the ſides of the patella to the cavity of the
joint itſelf. It inoſculates like the outer artery with the
lower arteries of its own ſide.

ARTERIA ARTICULARIS MEDIA.

THE MIDDLE or AZYGOUS ARTICULAR ARTERY
uſually ariſes from the back part of the popliteal artery,
but ſometimes from one or other of thoſe laſt deſcribed ;
but this branch, at all events, is ſeldom wanting. It
runs down behind the main artery upon the back part
of the joint, into the great hollow betwixt the condyles ;
and all its branches are expended upon the back of the
capſule, the poſterior crucial ligament, the ſemilunar
cartilages, and the fat about the back of the joint.

LOWER ARTICULAR ARTERIES.

THE lower articular arteries are more ſlender, longer,
run downwards very low, and return upwards with a
very ſudden angle.

ARTE-

ARTERIA ARTICULARIS INFERIOR EXTERNA.

The external ARTICULAR ARTERY below the KNEE goes off from the popliteal at the middle or centre of the joint, turns downwards along with the popliteal artery for a confiderable way; it paffes under the heads of the fmall plantar mufcle and the outer head of the gaftrocnemius, and having paffed through, encounters the head of the fibula, and paffes above it to the fide of the joint, fpreading its branches towards the patella.

In the ham this artery gives mufcular branches to the heads of the mufcles, as of the gaftrocnemius, folæus, plantaris, and the popliteal mufcle, that mufcle which lies obliquely acrofs the ham. When it reaches to the fide of the joint, it paffes under the external lateral ligament; and feveral of its branches, befides their external anaftomofes, go into the cavity of the joint, one of which within the joint is efpecially large.

ARTERIA ARTICULARIS INFERIOR INTERNA.

The INTERNAL ARTICULAR ARTERY below the knee is larger than the external one. Like it, it bends downwards, paffes under the inner head of the gaftrocnemius mufcle, croffes behind the head or rather neck of the tibia, on the inner fide of the knee. It firft gives arteries to the back of the joint; then it communicates downwards with a large recurrent artery from the tibialis antica; it inofculates upwards with the articularis fuperior interna; it contributes (as all the other articular arteries do) to the forming of that profufe network of arteries which is fpread over the whole of the capfule of the knee-joint. It fends alfo, like the others, certain twigs, which creep under the internal lateral ligament, and go into the cavity of the joint along the borders of the femi-lunar cartilages.

Thofe who write on aneurifms of the ham talk much of thefe arteries. They compare them with the recurrents of the arm; and think, when they fee five articu-

lar

lar arteries, that it is a fure fign that at fuch a point all
is fafe ; when thefe arteries are all deftroyed by the long
compreffion of the popliteal aneurifm, or are ingulphed
in the bag of the aneurifm. If they ever appear, it is
not as inofculating arteries, enfuring the fafety of the
limb ; but as fmall branches burfting into the fac, em-
barraffing the operator, and confounding every thing,
fometimes filling the fac a-new with blood, after all was
thought to be quite fafe, and the patient laid in bed.

Before the popliteal artery paffes under the head of
the folæus, it gives two long arteries, which run down
upon the two heads of the gaftrocnemii mufcles. It often
alfo fends fmall twigs to the head of the folæus, and to
the popliteal and plantar mufcles.

OF THE THREE ARTERIES OF THE LEG
AND FOOT.

The three arteries are, the tibialis antica, going on
the fore-part of the leg ; the tibialis poftica, paffing deep
along the back part of the leg ; and the peronea, which
is the fmalleft and leaft regular artery of the leg, and
which has its name from paffing down behind the
fibula. The popliteal artery divides below the ham,
under the longer head of the folæus mufcle, into two
arteries, the tibialis antica, and tibialis poftica. The
tibialis poftica continues its natural direction downwards
under the folæus mufcle, and behind the tibia.

ARTERIA TIBIALIS ANTICA.

The tibialis antica makes a fudden turn forwards,
perforates the interoffeous membrane juft under the
lower edge of the popliteal mufcle ; paffes out towards
the fore-part of the leg, betwixt the heads of the tibia
and fibula : but ftill it does by no means become a fu-
perficial

perficial artery; on the contrary, it lies deep betwixt the heads of the tibialis anticus and the extenfor of the toes; and is covered here with a very ftrong fafcia. It is only about fix inches above the ankle that the leg grows tendinous and naked; there this anterior artery can be felt beating: it lies betwixt the tendons of the tibialis anticus mufcle and that of the extenfor of the toes; it paffes down along with thefe tendons, through the annular ligament, and over the bones of the tarfus; it fends one branch acrofs the foot, another forward to the great toe; but the artery itfelf dives betwixt the firft and fecond metatarfal bone in the middle of the foot, and fo gets to the fole, where it ends in inofculations with the back arteries.

There is here fomething like a pofterior recurrent artery; for the tibial artery, before it paffes out of the ham, gives a fmall branch which afcends towards the back part of the joint, and is diftributed to the heads of the bones, viz. the tibia and fibula, and to the origin of fome of the mufcles.

ARTERIA RECURRENS.

THERE is here an ANTERIOR RECURRENT, larger than any in the arm, and much refembling the recurrens interoffea. It is a branch which comes off from the fore-part of the tibial artery, inftantly after it has perforated the interoffeous membrane; it turns immediately upwards under the flefh of the tibialis anticus; it gives many mufcular branches, fome to the head of the tibialis, others to the upper part of the extenfor digitorum, and branches go round the head of the fibula to the origin of the long peronæus mufcle. One branch goes directly upwards, and fpreads all over the lower part of the knee-joint, mixing its branches in the common vafcular net-work.

The tibialis antica gives no other branch of importance, or which fhould be named, even from the place of this recurrent quite down to the ankle-joint; for this, like the radial, or femoral, or any long mufcular
artery,

artery, continues giving off branches from either hand
to the mufcles betwixt which it runs, of equal fize
nearly, and all equally unimportant.   The tibial artery,
then, as it runs down the fore-part of the leg, gives
branches to the Tibialus Anticus on one hand ; to the
Common Extenfor of the toes on the other hand ; and
to the Extenfor of the great toe, which is the laft of the
three mufcles that occupy the fore-part of the leg.   It
alfo gives little arteries to the tibia, to the fibula, and to
the interoffeous membrane which lies betwixt them ;
but ftill it arrives unexhaufted at the fore-part of the
ankle-joint.

But before it croffes the joint (which it does by paf-
fing obliquely along with the tendon of the great toe),
it gives out two malleolar arteries, *i. e.* two arteries,
one to the outer, and one to the inner ankle.

ARTERIA MALLEOLARIS INTERNA.

THE ARTERY of the INNER ANKLE goes off juft
where the head of the tibia begins to bulge.   It turns
over the inner ankle in many fmall branches ; fome
mounting upwards along the tibia, but more going
downwards over the inner fide of the joint, *i. e.* over
the tibia or inner ankle, over the aftragalus, and fome
down as low and as far backwards as the heel-bone.

ARTERIA MALLEOLARIS EXTERNA.

THE ARTERY of the OUTER ANKLE goes off a little
lower down.   It fends fmaller branches upwards round
the outer ankle, which go to the Peronæus Brevis muf-
cle, to the joint, and to the common extenfor of the
toes, inofculating round the outer ankle with the fibular
arteries.   But its chief branch defcends along the fore-
part and outer fide of the foot, gives twigs to the fhort
extenfor of the toes, and ends in inofculations with the
tarfeal arteries, or arteries belonging to the fore-part of
the foot.

The arteries which belong to the fore-part of the foot
are ufually three in number: One goes off from the
tibial

tibial artery a little above the ankle-joint, and is named Arteria Tarſea, becauſe it croſſes the foot over the bones of the tarſus. To this ſucceeds a ſecond about the diſtance of half an inch from it, and which croſſes the foot at the place of the metatarſal bones; it is named Arteria Metatarſea: and the one or other of theſe gives the interoſſeous arteries, accordingly as the one or the other is ſmall or wanting. The third is that remarkable branch which goes forwards along the great toe, whence it is named Arteria Halucis.

ARTERIA TARSEA.

THE TASRAL ARTERY, which is ſometimes of a very conſiderable ſize, almoſt equal to the tibialis itſelf, comes off a little below the ankle, upon the forepart of the foot. It lies upon the ſecond rank of the tarſal bones; it paſſes under the head of the extenſor brevis of the foot; it croſſes the foot obliquely, ſo as to end in the abductor muſcle of the little toe, and in inoſculations with the arches of the ſole of the foot.

This branch gives ſmall inoſculating arteries upwards, which firſt give branches to the joint, and then join with the external malleolar and peroneal arteries. Next it gives branches to the bones and joints of the tarſus, which it lies upon; as the cuboid and cuneiform bones, and their joints. Thirdly, It gives ſmall arteries to the bellies of the extenſor brevis, where it lies under it.

But its greateſt arteries are the interoſſeous arteries, which it ſends along the interſtices betwixt the metatarſal bones. Theſe interoſſeous arteries are three in number; they run along in that interſtice which holds the interoſſeous muſcles; and when they arrive at the end of that furrow, or, in other words, at the place of the forking of the toes, each interoſſeous artery turns down to the ſole of the foot, and goes into the fork of each digital arch, on the loweſt ſide of the toes. Sometimes theſe arteries give alſo ſmall dorſal arteries to the backs of the toes.

The tibial artery having proceeded along the tarſal bones,

bones, and arrived at the lower heads of the metatarfal bones, and having firft given off fome trivial branches to the joints of the foot on its inner fide, and to the bones and mufcles about the root of the great toe, next gives off a metatarfal artery *.

ARTERIA METATARSEA.

THE ARTERY of the METATARSUS or inftep goes off at the head of the firft metatarfal bone. It bends acrofs the roots of the metatarfal bones to the root of the little toe; and it diftributes branches to the tendons of the peronæi mufcles, and ends in the abductor of the little toe, and in the fkin over the outer edge of the foot. But fometimes it is a larger and more important artery; for when the tarfal artery is fmall or wanting, this metatarfal one gives off the interoffei, and fupplies its place.

DORSALIS EXTERNA HALUCIS.

THE third branch is the ARTERY of the BACK of the GREAT TOE. This artery is of very confiderable fize; it gives no mufcular branches, becaufe it lies upon the bony part of the foot; it runs all along the metatarfal bone which fupports the great toe; and it ends at the forking of that toe in two great branches; one the dorfal artery of the great toe, which goes along it to the point; another to the fide of the toe next the great toe, which it alfo runs along, fomewhat like the forking arteries of the thumb and fore-finger.

The anterior tibial artery ends here (*i. e.* where it gives off the artery of the great toe). By finking in betwixt the metatarfal bones of the great toe and of the toe next to it, and going directly into the arches of the fole of the foot, it produces a great and important anaftomofis, fimilar to that of the radial and ulnar arteries.

* N. B. Betwixt the tarfal and metarfal artery, there is ufually a fmall branch going o twards to the outer edge of the foot, *i. e.* in the fame direction with both thefe arteries, but very fmall.

ARTERIA

ARTERIA TIBIALIS POSTICA.

THE POSTERIOR TIBIAL ARTERY is so named from its passing along the back part of the tibia. The anterior tibial artery passes through the interosseous membrane only at the lower edge of the popliteal muscle: this artery comes off from the general trunk at the upper edge of the popliteal muscle, and passes obliquely towards the inside of the tibia, to take its place behind that bone. Its whole situation and general course is this: It lies over the tibialis posticus and flexor muscles; it lies under the bellies of the gastrocnemius and solæus; it turns round the inner ankle close upon the bone. Having passed the lower head of the tibia, it goes down along the inside of the heel-bone, in its deep arch, upon which the body is supported; it divides at the heel-bone, and advances along the sole of the foot in two great branches; one running along the sole, next the outer edge of the foot; the other along the inner edge of the foot; whence they are named external and internal plantar arteries. From this arch the artery gives branches to all the toes, and so it ends.

This posterior artery is chiefly a muscular one, at least in its course down the leg; and though it gives many branches as it passes along, there are hardly any worthy of being described: and from the knee to the ankle-joint there is one only which needs be distinguished by name, viz. the artery which nourishes the tibia.

First, The tibialis postica often gives arteries to the heads of the gastrocnemii muscles; next it gives off the ARTERIA NUTRITIA TIBIÆ, which begins a little below the lower edge of the popliteal muscle, runs downwards along the interosseous ligament, gives muscular branches to the popliteus, solæus, and tibialis posticus, and then sends the nutritious artery into the great hole in the middle of the tibia. It gives many branches to the periosteum of the tibia, and to the interosseous

membrane all down the leg, and it ends near the lower end of the tibia in inofculations with the peroneal artery.

Other namelefs mufcular arteries fucceed to this, going to the tibialis pofticus, to the flexor communis, and to the flexor of the great toe. When the artery arrives near the ankle-joint, it gives many fmall twigs to the periofteum, tendons, fheaths, and burfæ mucofæ behind the ankle; and then paffing in the very deepeft part of the ankle, under the annular ligament, and betwixt the tibia or procefs of the inner ankle and the heel-bone, it adheres clofely to the bones and capfule of the joint; and there gives a great many little tortuous arteries, making net-works over this joint and its bones, as over the other joints already defcribed. But efpecially two delicate arteries go out at this hollow at the fide of the heel-bone: one forwards towards the fide of the ankle-joint, the other downwards and backwards over the heel-bone, which ramify very profufely and very beautifully.

The artery now lying deep under the abductor magnus of the great toe, which arifes from the heel-bone, forks into its two great branches, the external and internal plantar arteries.

ARTERIA PLANTARIS INTERNA.

The internal plantar artery is much the fmaller branch, not to be compared in importance (though their names are contrafted) with the external plantar artery; and it is named internal, becaufe as it runs along the fole of the foot it keeps to the inner edge, viz. that to which the great toe belongs. It comes off under the head of the abductor of the great toe, and under the belly of that mufcle, and clofe upon the bone; its branches run forwards, quite up to the root of the toe, all along its metatarfal bone. The internal plantar artery has in general four branches, which all run pretty nearly in the fame direction, viz. ftraight forwards.

It

It gives, while under the head of the abductor, small branches, which go backwards to the joint, its capsule, and tendons, and some into the spongy substance of the heel-bone; some also to the short flexor of the foot, and to the massa carnea. But its four greater and more regular branches are these:

The first lies nearer the inner edge of the foot; is the largest and most considerable; it runs along under the inner border of the abductor; it goes quite up to the ball of the great toe, and unites with the proper artery of the toe. As it goes along it gives small twigs to the periosteum and bone.

The second resembles the former, except that it does not come off so early by two inches; it is of course shorter, but it passes along in the same direction, only a little distant from the first, lying along the middle of the metatarsal bone. It also advances up to the root of the great toe, and runs also into the proper artery of the great toe (which comes from the external plantar branch), so as to enlarge and strengthen it.

The third lies still nearer to the centre of the foot, and deeper among the muscles. It runs the same general course, viz. along the side of the metatarsal bone up to the ball of the great toe, and ending like the others in the artery of the great toe; but as it lies deeper, it gives branches to the short flexor, to the tendons, and to the inner surface of the aponeurosis plantaris, forming a sort of superficial arch.

From these three arteries, much of the skin on the sole of the foot has its branches.

The fourth and last branch of the plantaris interna, is one which goes down deep into the centre of the foot; it lies close upon those ligaments which bind together the bones of the tarsus, and under all the tendons, except those of the tibial muscles which are like ligaments to the bones. Its destination is chiefly to the tarsal joints and capsules; its inosculations with the external plantar artery can be of no importance.

PLANTARIS

PLANTARIS EXTERNA.

THE EXTERNAL PLANTAR ARTERY is the great ar-
tery of the fole of the foot, from which the arches of
the foot and the inofculations with the anterior tibial
artery are formed.

It turns outwards towards the outer edge of the
foot; it runs its great circle round by the metatarfal
bone of the little toe; and its plantar arch, or the arch
of the fole of the foot, paffes over the middle of all the
other metatarfal bones. It receives the anterior tibial
artery under the middle of the metatarfal bone of the
great toe. It is this great curve of the artery turning
round in the fole of the foot that we name the plantar
arch; and it is from it that all the proper arteries of the
toes arife, exprefsly after the fame order in which the
fingers receive their arteries.

The great or external plantar artery lies deep, but
not upon the naked bones like the former. It paffes
through betwixt the heads of the fhort flexor and maffa
carnea; it turns its firft turn outwards, till it gets under
the flexor and abductor of the little toe; then it turns
inwards towards the centre of the foot, and lies under
the tendons of the long mufcles, and over the metatarfal
bones and their interoffeous mufcles.

Firft it fends a large branch backwards to the heel-
bone, which belongs entirely to that fpongy bone,
forms, like all fuch arteries, a fort of net-work over all
the furface of the bone; it firft touches the bone under
its extreme point, or that which refts upon the ground;
and it goes branching over it fo high as to inofculate
round the ankle with twigs of the tibialis antica; it
gives branches alfo hereabout to the great ligament of
the heel-bone. The external plantar artery next gives
branches to thofe mufcles betwixt which it lies im-
bedded, viz. the maffa carnea and flexor brevis; then
advancing to the fide of the flexor digiti minimi, it
gives out two or three branches, which firft go into the
flefh of the abductor and flexor of the little toe, and
then turning over the edge of the foot, terminate in in-
ofculations

ofculations with the arteries of the fore-part of the foot
and in the fkin.

It then begins from the root of the metatarfal bone of
the little toe to form that great circle which is named
the arch of the foot, and which gives out two ranks of
arteries: Firft, Of interoffeous arteries going to the
fpaces betwixt the metatarfal bones, upon which the
toes ftand; and, fecondly, The proper arteries of the
toes themfelves.

The firft of thefe arteries proceeding from the tarfal
arch is a fmall one, the artery of the little toe. It be-
gins at the lower head of the metatarfal bone, lies under
the flexor and abductor mufcles, gives branches to thefe
mufcles and to the fkin, and to the bone itfelf; it runs
up the outer edge of the little toe, and this is imme-
diately fucceeded by the firft interoffeous artery; which
lies deeper, paffes along the firft interoffeous fpace, gives
branches to the bones and interoffeous mufcle, and in-
ofculates betwixt the toes with the branches of the an-
terior tibial artery.

The next artery is properly the firft of the great arch.
It is what is called the RAMUS DIGITALIS, or proper
artery of the toes. It is a long artery, runs over the
interoffeous fpace lying upon the interoffeous mufcles;
it advances to the root of the little toe, and like thofe
of the fingers divides into two branches, one to the
inner fide of the little toe, and the other to the fide of
the toe next it.——A fecond and a third DIGITAL ARTERY
go out in the fame manner, and fplit at the roots of the
toes into two branches, and with fo little variety that it
is needlefs to defcribe each part.

In the interftices of each of thefe arteries lie two or
three fmall perforating arteries, which perforating be-
twixt the metatarfal bones inofculate with the interoffe-
ous arteries which lie on the fore-part of the foot.

But the great external plantar artery, while it is
giving out thefe arteries alternately, i. e. large branches
to the toes, and fmaller twigs to the interoffeous mufcles,
and fome fmaller ftill which go off from the concave
part of the arch, and go into the fole of the foot to the

T 3   ligaments

ligaments and joints ; the great artery goes ftill onwards, and completes its arch at the middle of that metatarfal bone which fupports the great toe. There, a little behind the ball of the great toe, it receives the tibialis antica, which perforates from the fore-part of the foot. This completes the arch of the anterior and pofterior arteries, and permits the blood to pafs, according to the preffure or other accidents, in either direction ; and this union ftrengthens and enlarges the artery of the plantar arch fo much, that it is not exhaufted by the many branches which it has given off, but gives at this point the largeft artery of all, viz. the artery which fupplies the great toe and one fide of the toe next it. This artery of the great toe is the very laft or extreme branch of the aortic fyftem. It very clofely refembles the great artery of the thumb ; it gives out three chief branches, viz. one to each fide of the great toe, and one to the inner fide of the toe next it. This ARTERIA POLLICIS PEDIS fometimes feems to proceed entirely from the perforating branch of the anterior tibial artery ; at other times it arifes fairly from the plantar arch.

ARTERIA PERONEA.

THE FIBULAR ARTERY, or the third artery of the leg, which is much fmaller than thefe two, is to be regarded rather as a branch of the anterior tibial artery ; and in its courfe and connections, and its being exhaufted nearly by the time it reaches the ankle-joint, it greatly refembles the interoffeous of the fore-arm, which ftops below the wrift, or paffes it only with fmall and extreme branches.

Where the tibialis antica paffes through the interoffeous ligament, the arteria peronea breaks off from it, almoft of equal fize with itfelf, and paffes down behind the fibula, whence it has its name. It arifes near the head or origin of the tibialis pofticus mufcle, and accompanies that mufcle down to the ankle-joint, lying betwixt it and the flexor of the great toe.

This

This is entirely a mufcular artery for fupplying thofe deeper parts which the other arteries do not fupply. Its branches, like thofe of all mufcular arteries, are extremely irregular; its chief branches are to the folæus, to the peronæi mufcles; to the tibialis pofticus, to the flexor of the great toe. Several little arteries turn round the fibula from point to point, going to the fore-part of the leg. All the way down the leg, it is giving off repeated branches to the fame mufcles; and in this courfe it gives fome little arteries, which pierce through the interoffeous membrane, and alfo gives the nutritious artery of the fibula.

When it approaches the ankle-joint, the fibular artery gives off an anterior branch, which perforates the interoffeous membrane, paffes through betwixt the tibia and fibula nearly where they are joined; it turns downwards over the outer fide of the ankle, by the extenfor pollicis and peronæus brevis tendons. This is named PERONEA ANTERIOR, though it is an artery of little importance. Its branches are given not to mufcles, for this is a naked and bony part of the foot; but are expanded upon the lower heads of the tibia and fibula, and upon the os cuboides. They nourifh the tendons, ligaments, and burfæ of the outer ankle; they end in inofculations with the malleolar artery, from the tibialis anterior, and with the tarfal artery.

ARTERIA PERONEA POSTERIOR.

As this ANTERIOR FIBULAR ARTERY branches over the fore-part of the outer ankle, the POSTERIOR FIBULAR ARTERY paffes deep behind the fame ankle, and is juft the continuation of the main artery; which having paffed down behind the acute angle of the fibula, finks into that deep hollow which is behind it upon the fide of the heel-bone. Behind the tibia the artery makes large inofculations with the pofterior tibial artery, and gives many branches to the tendons. Branches alfo turn round the ankle, making a net-work of veffels upon it, and inofculating with the anterior tibial artery.

It

It continues to give the fame fmall arteries to the outer ankle, to the peronæi tendons, to the outer fide of the heel-bone, and to the abductor of the little toe. It ends ufually in that mufcle, and in inofculations with that branch of the external plantar artery which turns back-wards upon the heel-bone and ramifies upon it fo beautifully.

Thefe are the laft branches of the three great arteries of the leg and of the aortic fyftem.

DESCRIPTION

THE VENOUS SYSTEM.

CHAP. I.

OF THE VEINS IN GENERAL.

THE veins are the veffels by which the blood carried outward by the arteries is returned to the heart. The fyftem of the veins, however, is not fo fimple as that of the arteries, for while there are only two great arteries carrying the blood from the heart, viz. the aorta and the pulmonic artery, there are three great trunks of the veins, viz. the fuperior and inferior vena cava, the trunks of the great veins of the body; the pulmonic vein, which returns the blood to the heart from the circulation through the lungs; and the vena portæ, which collects the blood of the inteftines, and conveys it to the liver. There are befides, a greater variety in the diftribution of the veins, than in that of the arteries.

The French phyfiologifts have departed from the old method of Harvey, in explaining the circulation. He wifely took the heart as the centre of the fyftem, and defcribed the veffels going out from it, forming the two circulations, viz. through the body and through the lungs; but they have affumed the lungs as the centre; and the veins of the body, and the arteries of the lungs, they call *fyfteme à fang noir*, becaufe it contains the dark-coloured blood; and the pulmonic veins and the arterial fyftem of the body, they call *fyfteme à fang*

fang rouge, becaufe it conveys blood of the bright ver-
milion colour.

This conceit is perhaps admiffible, when introduced
as an additional illuftration of the relation of the lungs
to the body ; but it caufes in a difficult fubject an unufual
degree of intricacy, and does not ferve the purpofe of
demonftration : befides, the arteries and veins of the
body, and the pulmonic artery and vein, have that
ftrict and mutual dependance in action, which fhews
how improper and how unnatural it is to make this
change, and to feparate them in explaining the general
fyftem.   At all events, let thofe who adopt this novelty
ceafe to fpeak of the two circulations, for although in
regard to the heart, there are two circulations, yet as
the movement of the blood refpects the lungs, there is
only one.   By this divifion, the blood returning from
the body and carried into the lungs, cannot be called a
circulation ; but only when it has paffed through the
lungs, and returned to the fame point of its courfe
through the body.

I retain the old method, correfponding with what has
been delivered in the preceding volume, and in defcrib-
ing the veins will follow the courfe of the blood through
them.

GENERAL CHARACTER OF THE VEINS.

The capacity of the veins is greater than that of the
arteries ; the coats are thinner but ftronger compara-
tively, and admit eafily of dilatation to a certain extent.
The coats of the leffer veins are comparatively ftronger
than thofe of the larger ones, and the veins of the lower
extremity much thicker and ftronger than in the upper
parts of the body, as they have to bear a higher column
of blood.   The veins are tranfparent and the blood is
feen through their coats.   There can be properly diftin-
guifhed, only two coats in the veins : the outer coat,
which is floculent and cellular without, to connect with
the furrounding parts, fmoother and more compact
within, where it is united with the inner coat.   In it are
                                                    ramified

ramified the vafa vaforum ; and a fibrous ftructure is to
be obferved in fome of the larger and fuperficial trunks ;
thefe ftriæ or fibres run longitudinally *. The inner
coat is firm and compact and intimately united to the
other ; it is fmooth, flexible, and formed into valves in
various parts ; which valves are femi-lunar, and refemble
thofe in the root of the great·arteries in the heart.
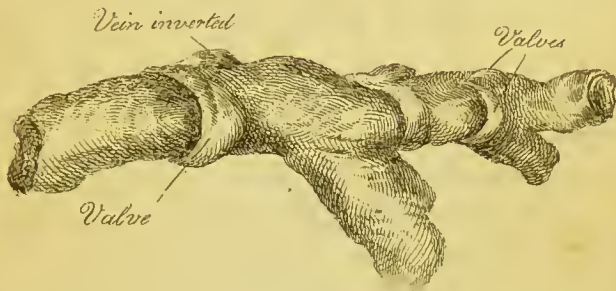
In all the larger veins, excepting thofe of the vifcera
of the abdomen, and thofe of the lungs and brain,
there are valves ; but in the fmaller veins there are no
valves : thefe valves confift of the inner coat, forming
folds like a curtain, hung acrofs the calibre of the vein ;
but at the fame time attached fo obliquely to the fide of
the vein, that they prefent a facculated membrane to
receive the refluent blood. The loofe margin of the
valve is fomewhat ftronger than the other part, and be-
twixt the duplicature fome fplendid little filaments are
fometimes obferved. Each valve confifts, in general, of
two femi-lunar membranes, the margins of which, fall-
ing together, prevent the blood from paffing retrograde ;
but they yield and give freedom to the current of blood
when flowing towards the heart.

* Unlefs near the auricle no mufcular fibres have been obferved.
See *Halleri Opera Minora*, p. 175;

Authors

Authors have not noticed a part of the ſtructure eſſen-
tial to the operation of a femi-lunar valve. I mean the
little ſinuſes or more dilatable part of the coats of the
veins juſt above the attachment of the valve. Theſe
ſinuſes are of the ſame uſe here that they are in the ori-
gin of the great arteries from the heart. The blood
running back dilates them, and thus catches the margin
of the valve and throws it down. Without this pro-
viſion, the valve being collapſed to the ſide of the vein,
the blood might be permitted to paſs retrograde.

A ligature high on the arm or thigh not only cauſes
the veins to ſwell by preventing the free courſe of the
blood back to the heart, but it ſhews the veins in their
diſtinct and natural character, and cauſes the ſinuſes of
the valves to riſe, ſhewing the places of the valves.

The ſacs formed by the valves of the veins are much
deeper ſometimes than the term femi-lunar implies, in-
ſomuch that the term pyriformis has been uſed. Neither
are the valves always double, for ſometimes they are
ſingle, and ſometimes three in number *. They are beſt
ſeen by opening the veins under water.

As the veins are provided with valves only where they
are expoſed to occaſional preſſure, and particularly to
the compreſſion of the muſcles ; the uſe of the valves
would ſeem to be, to prevent the retrograde movement
of the blood, in conſequence of the occaſional compreſſion
of the veins ; but no doubt, they at the ſame time ſup-
port the column of blood, as in the lower extremities :
and when thoſe veins ſuffer diſtention by diſeaſe, a
great aggravation is, that the valves loſe their action,
for the vein is now too large to be cloſed by them, and
the whole column of blood preſſes upon the veins of the
legs.

Fabricius ab Aquapendente, who diſcovered the valves
of the veins, though ignorant of the circulation, and of
the true uſe of the valves conſequently, yet argues very
ingeniouſly ; for he imagined that exerciſe by heating

* Fabricius de Venarum Oſteolis. Morgagni Epiſt. Anatom. XV.
Kerckringii Spicilegium Anatomicum, Tab. 4.

the

the limbs would draw the blood from the trunk, to the injury and rupture of the veffels of the limbs, and the too great diminution of nourifhment in the vital parts, were it not for the office of thefe valves.

The commencement of the minute branches of the veins, is from the extreme ramifications of the arteries; they are continuous, and convey back the blood in that courfe which is called the circulation. In contemplating the capillary tiffue of veffels, the moft ftriking circumftance is, the predominance of the dark venous ramifications: and in general two fets of veins will, even in thefe minute ramifications, be obferved; one fuperficial, the other more intimately blended with the minute ramifications of the arteries; but in the internal parts of the body, and particularly the vifcera, the veins uniformly accompany the ramifications of the arteries, and in the folid vifcera, a denfe cellular membrane gives lodgment to both fets of veffels.

In the extremities and head, indeed every where but in the vifcera, the veins form two diftinct fets; the deep and the fuperficial veins: the deep veins accompanying the arteries; and the fub-cutaneous veins, which emerge from the compreffion of the mufcles, and run above the fafcia. The union betwixt the branches of the veins, is very frequent, not only betwixt the veins, ramifying in the fame plane in fo much as to make them a mere net-work; but alfo betwixt the deep and the fuperficial fet of veins: fuch are the venæ emiffariæ of the fkull, the free communications betwixt the external and internal jugular vein, betwixt the deep and fuperficial veins of the arm, &c. When in bleeding, the blood flows from the vein of the arm, accelerated by the working of the mufcles, the blood efcapes by the anaftomofis, from the compreffion of the mufcles, and fills the fuperficial veins; but the increafe of the jet of blood, is principally produced by the fwelling of the mufcles, caufing the fafcia to comprefs the internal veins of the fore-arm.

In the dead body the veins are flat, but when diftended, they refume the cylindrical figure which they
<div align="right">poffeffed</div>

poffeffed in the living body.; yet they are in general of the cylindrical figure for a very fmall part of their courfe only, owing to the irregular dilatations by the fide of the valves, or by the frequent union of their branches. The manner in which the branches join the trunk, has a peculiarity which always diftinguifhes them from the ramifications of arteries : the arteries branch direct and at an acute angle, the veins in a direction more removed from the courfe of the trunk, and in general with a curve or fhoulder.

In infancy and youth, the veins are little turgid, and efpecially the cutaneous veins are fo firmly embraced by the elaftic fkin and cellular membrane, that they have a lefs degree of prominency than in more advanced years. In old age, the veins are enlarged, and rife turgid on the furface, and the internal veins alfo become enlarged and varicofe.

Soemmerring fays, with increafing years the refifting power of the veins is diminifhing, that of the arteries increafing *. I believe this to be incorrect in regard to both kinds of veffels.

I do not confider the change in the vafcular fyftem, as the effect of mere diftention, or of the enlargement of the veins, from the long continued action of the arteries ; but as a neceffary change in the proportionate diftribution of the blood, which is preceded or accompanied with other peculiarities, the character of old age. When we confider the great fize of the veins compared with the arteries, we muft conclude that the blood flows but flowly in the venous fyftem : that from the narrownefs of the trunks of the veins near the heart, the blood muft be accelerated as it approaches the heart ; and that receiving the impulfe from the ventricle, it muft take a rapid courfe through the arteries, until again approaching the extreme branches of the arteries and paffing into the veins, its motion becomes more languid and flow. In youth, as the fize of the veins is not in fo great a proportion to the arteries, as in advanced life,

* Vol. v. § ccxxviii.

the

the blood in a young perfon, muft be in more rapid and quick circulation: but in old age, owing to the largenefs of the veins and the accumulation of blood in them, the blood moves flowly through the venous fyftem, and is almoft ftagnant in the dilated veins and finufes; upon the whole, it moves lefs brifkly through the veffels, and the proportionate quantity immediately under the influence of the arterial fyftem, is lefs than in youth.

There is no pulfation to be obferved in the veins, but what they receive laterally from the contiguous arteries. There is no pulfation in the veins, becaufe they are removed from the heart; becaufe they do not receive the fhock of the heart's action in their trunk, but only by their widely-fpread branches; becaufe the contraction of the heart, and of the arteries fo alternate with each other, as to keep up a perpetual and uniform ftream of blood into the veins; whereas the pulfation in the arteries is owing to the fudden and interrupted contraction of the heart.

In living animals I have undoubtedly feen the courfe of the blood in the great veins near the heart alternately checked and accelerated in its motion. But this is a fubject which I have no difpofition to purfue. This motion does not prove that there is here a mufcular contraction *.

I have diftinctly feen a white fluid in the extremities of the veins of the human inteftines.

In this general account of the venous fyftem, it remains only to fpeak of the fubject of abforption. Before the fuite of experiments made on this fubject by Mr. Hunter, a vague notion was entertained that the veins were abforbents; but about that time †, the doctrine that lymphatics were abforbents having been eftablifhed, the opinion that the red veins were alfo abforbents, was

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* *Haller* found contraction produced in the veins by touching them with oil of vitriol. *Opera Minora,* p. 375.
† 1758.

firft

firſt queſtioned, and finally confuted, at leaſt in the opinion of moſt phyſiologiſts.

The chief argument to ſhew that veins, ariſing from cavities, particularly from the inteſtines, acted as abſorbents, was, that ſome anatomiſts ſaid they had ſeen white chyle in the blood taken from the meſenteric veins. It was, however, ſoon obſerved that the ſerum of the blood, taken from the veins of the arm, was ſometimes white, which muſt ariſe from ſome other cauſe than the abſorption of chyle *.

The experiments of Mr. John Hunter, proved that there is no abſorption of fluid, from aliment contained in the inteſtinal canal, by the veins of the meſentery, while the lacteals were rapidly abſorbing. Emptying a portion of the gut, and the veins of their blood in a living animal, he poured milk into the inteſtine. The veins remained empty, and without a drop of the milk finding its way into them, while the lacteals became turgid with it. In another experiment, leaving the arteries and veins of the meſentery free, and the circulation through them perfect; ſtill no white fluid could be diſcovered, tinging the ſtream of blood in the veins. Neither did preſſure upon the gut, in any inſtance force the fluid of the inteſtines into the veins.—He repeated and varied theſe experiments, ſo as to ſhew, in a very ſatisfactory manner, that chyle, or the fluid of the inteſtines, never is abſorbed by the veins.

Yet I muſt ſay that theſe experiments are ſtill unſatisfactory, as they regard the general doctrine of abſorption by the veins: in the inteſtines there is a peculiar ſet of veſſels evidently deſtined to the abſorption of the chyle and of the fluids of the cavity; but there remains a queſtion which will not be eaſily determined: do not the veins throughout the body reſume a part of that ſubſtance, or of thoſe qualities, which are depoſited or beſtowed by the blood of the arteries?—Are we aſſured that in the circulation of the blood through the lungs, and in

* See Hewſon, Exper. Eſſays and Lymphatic Syſtem.

the

extremities of the pulmonic veins, there is no imbibing or abforption ? In the veins of the placenta, there is not only an operation fimilar to what takes place in the extreme branches of the pulmonic circulation, but the matter and fubftance which goes to the nourifhment of the foetus, is imbibed from the maternal circulation *. So by the veffels in the membrane of the chick in ovo, there is abforbed that which being carried to the chick, beftows nourifhment and encreafe. For my own part, I cannot but fuppofe that, while the lymphatics abforb the loofe fluids which have been thrown out on furfaces, or into cavities—the veins receive part of what is depofited from the arteries ; but, which is not fo perfectly feparated from the influence of the circulating fyftem, as that which the lymphatics receive ; and that there are certain fluids, which, by an affinity of the venous blood they imbibe in the courfe of the circulation. We muft at the fame time acknowledge, that the conclufions made in favour of abforption by veins, from experiments upon the dead body, are fallacious, and have no weight.—It is feldom we can determine whether minute injections have taken a courfe by a natural, or by a forced paffage : neither are the experiments of fome of the older phyfiologifts more fatisfactory or conclufive. Lower affirmed that, by throwing a ligature on the inferior cava of a dog, he produced afcites. He tied the jugular veins of a dog, and the head became dropfical. Hewfon repeated thefe experiments, but without the fame refult. And if the tying of the veins had always produced oedema or dropfy, the experiment would have proved nothing more than is already eftablifhed by the very common occurrence of oedema of the legs, from the preffure of the womb on the iliac veins, or a tumor in the groin, or in the pelvis. Now in thefe inftances the compreffion of the vein does

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* Dr. Hunter, Hewfon, &c. fay that it is probable there are many fmall lymphatics in the placenta, which open into the branches of the veins, and do not take a courfe along the cord. This is very improbable, and has no fupport from analogy.

nothing more than caufe a difficult circulation of the blood, from the extreme arteries into the veins, and confequently a greater profufion of the difcharge into the cellular texture by the ferous arteries.

SECTION I.

OF THE VEINS, BRANCHES OF THE SUPERIOR VENA CAVA.

THE fuperior vena cava, or the defcending cava, is the fuperior trunk of the venous fyftem; which receives the veins of the head, neck, and arms, and throws the blood directly into the great right finus, or auricle of the heart.

But I hold it better to begin my defcription from the extremities of the veins, following the courfe of the blood. I therefore commence with the veins of the forehead.

OF THE VEINS OF THE HEAD AND NECK.

THE ANTERIOR FACIAL VEIN *. The facial, or anterior facial vein, runs down obliquely from the inner canthus of the eye, towards the angle of the lower jaw-bone. Here uniting with the temporal vein, it forms the external jugular vein. The moft remarkable branches of veins which affift in forming the facial vein, are the FRONTAL VEINS; which receive the blood from the forehead and frontal portion of the occipito-frontalis mufcle, and the OPHTHALMIC VEIN, which is one of the emiffariæ, and comes from the cavernous finus through the orbit.—In its courfe down the cheek, the facial vein receives the feveral cutaneous branches of

* *Facial vein; V. Angularis; V. Triangularis.*

the

the veins from the furrounding parts : but which have in reality no fuch importance as to require defcription *.

THE POSTERIOR FACIAL VEIN †; or, GREAT TEMPORAL VEIN.—This vein defcends from the temple before the ear, through, or under the mafs of the parotid gland, and behind the angle of the lower jaw.

This pofterior vein receives thofe branches which are the proper temporal veins, and which are four in number, and defcend upon the fide of the head ‡; and thofe which anfwer to the fubmaxillary artery, and alfo the vena tranfverfa faciei, and the auricular veins. Finally into fome of the deep branches of this vein § the blood enters from the veins accompanying the arteria meningea. The pofterior facial vein, uniting with the anterior one, forms a common trunk, which in general lies over the divifion of the carotid artery.

EXTERNAL JUGULAR VEINS.

THE external jugular vein takes a courfe obliquely down the neck, and acrofs the middle of the mafloid mufcle. It lies under the fibres of the platyfma myoides mufcle, and drops either into the fubclavian vein, or into the internal jugular vein. Sometimes there are two external jugular veins on each fide.; more commonly there are two branches high in the neck, from the anterior and pofterior facial veins, which unite about the middle of it. When they are double they have this courfe ; the *anterior and external* jugular vein, may be faid to begin from the anterior facial vein ; it then receives the fubmental vein, which comes in under the bafe of the lower jaw—the ranine veins alfo, and veins

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* *Vena dorfalis nafi, fuperior et inferior—Vena palpebralis inferior externa et interna—Vena alaris nafi—Venæ labiales magnæ et minores,* &c.—*Venæ buccales,* &c.

† *Joannis Gottlieb Walteri, tab.* ii. 65.—*Venarum Capitis et Colli.*

‡ Being in two fets, the deep, and fuperficial. Walter. tab. ii. —*Vena tempor. fuperf.* 110. *et Vena temp. profund.* 111.

§ *Viz. Venæ Pterygoideæ.*

from

from the glands under the jaw join it here : where it is
before the maftoid mufcle, it forms free communica-
tions with the internal jugular veins ; and here alfo, it
receives veins from the fide of the throat *.

Almoft all the ramifications of veins, which in one fub-
ject unite to the external jugular vein, and which come
from the face and throat, do in others fink down into
the internal jugular vein †.

Sometimes the anterior and external jugular veins
join the internal jugular vein ; fometimes the fubcla-
vian vein.

THE POSTERIOR EXTERNAL JUGULAR VEIN is
formed chiefly by the temporal vein, or, pofterior facial
vein, which comes down from under the parotid gland ;
it is then joined by the occipital veins ‡, a little lower by
the cervical veins, and laftly, on the lower part of the
neck it receives the mufcular branches from the flefh of
the fhoulder ; it then finks into the fubclavian vein.

OF THE THYROID VEINS.—The thyroid gland has
two fets of veins, as it has of arteries ; the *fuperior
thyroid* veins carry back the blood from the mufcles of
the fore-part of the throat, from the larynx, from the
fubftance of the thyroid gland, and from the neigh-
bouring part of the trachea and pharynx, and even from
the fauces. Sometimes thefe thyroid veins enter the
external jugular vein ; fometimes they defcend upon the
neck, taking the name of GUTTURAL VEINS, and unite
themfelves with the internal jugular vein.

THE LOWER THYROID VEINS come from the lower
part of the thyroid gland, and defcend upon the fore-
part of the trachea, and enter the fubclavian ; or, more
generally, the great, or internal jugular veins.

OF THE INTERNAL JUGULAR VEIN.—JUGULARIS
INTERNA §.—VENA JUGULARIS CEREBRALIS ‖.—The

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* Viz. The fuperior thyroid veins, and the deep laryngeal veins.
† Walter loc. cit. tab. ii. 13.
‡ Thefe communicate with the vertebral veins, and through the
pofterior maftoid foramen with the lateral finus.
§ Haller. icon.
‖ Walter.

internal

internal jugular vein is formed by the conflux of the feveral great and pofterior finufes of the dura mater into the lateral finus, which coming out by the foramen lacerum pofterius of the bafis cranii, ceafes to be conftricted into the triangular fhape, and takes the form and peculiarities of a vein. From this foramen, common to the temporal and occipital bone, the jugular vein defcends obliquely forward and downward, becoming from its deep fituation fomewhat more fuperficial, but in all its extent protected by the fterno-cleido-maftoideus mufcle, and paffes under the omo-hyoideus mufcle. The internal jugular vein is very irregular in its form; being fometimes much contracted under the angle of the jaw; bulging and much enlarged, or rather capable of being much diftended in the middle of the neck; and again contracted before it joins the fubclavian vein. The carotid artery, the internal jugular vein, and the par vagum lie together in the fame fheath of loofe cellular membrane. The vein is to the outfide of the artery, and the nerve is betwixt them.

The internal jugular vein receives thefe communications and branches; behind the angle of the lower jaw, a branch of communication generally goes down from the pofterior facial vein, and often it is joined by the internal maxillary vein: under the jaw, it either forms free communications with the beginning of the external jugular vein, or it receives the ranine and guttural veins; at all events, there is a branch from the fide of the throat, and the mufcles of the os hyoides which paffes into the internal jugular vein. From under the back part of the maftoideus mufcle, it receives branches from the occipital veins, and forms communications with the vertebral veins. Near its termination the great jugular vein receives the guttural and lower thyroid veins.

OF THE VERTEBRAL VEINS.—There is difficulty in affigning origins to thefe veins, for they are rather like a chain of communication; they run in the holes of the tranfverfe apophyfis of the cervical vertebræ, and furround the proceffes with areolæ. Firft, a communica-

tion

tion is formed with the great lateral finus, then they receive the flat finufes from under the dura mater, covering the cuneiform procefs of the occipital bone, (the bafilar finufes) and as they defcend 'they form tranfverfe communications, which receive the branches of that chain of inofculations, which runs down upon the fpinal marrow. The vertebral veins, in their defcent, fend out divifions which run down upon the outfide of the canal, and receive branches of veins from the mufcles on the fore-part of the vertebræ, and fome of the proper cervical veins from behind. The *vena cervicalis* coming from the fide of the neck, unites with the vertebral vein near its termination, in the back part of the fubclavian, or fometimes in the axillary vein.

SECTION II.

OF THE VEINS OF THE ARM.

THE veins of the arm are in two fets, the venæ co- mites; and the external or fub-cutaneous veins, being thofe without the fafcia, and not fubject to the com- preffion of the mufcles. Of thefe, the latter are the more important and require a particular defcription.

On the palm of the hand, the veins are few and fmall, becaufe they are there fubject to compreffion in the frequent grafping of the hand; but on the back of the hands and fingers, the veins are numerous and large. The veins creeping along the fingers, make a remarkable inofculation on the back of the firft pha- langes, and then paffing in the interftices of the knuckles, form a great and irregular plexus on the back of the hand *: the principal branch of which fometimes takes the form of an arch †.

* *Plexus dorfalis manus.*   † *Arcus venofa dorfalis,*

The

The plexus of veins from the back of the hand is continued over the back of the wrist : when some of the larger branches, after playing over the heads of the radius and ulna, take a course, the one on the lower, and the other over the upper edge of the arm, whilst the back of the arm is left without any remarkable veins taking their course there.

The veins on the back of the hand have nerves intermingling with them, viz. branches of the ulnar nerve, and the extreme branches of the muscular spiral nerve ; so that it is a great mistake to suppose that bleeding in the back of the hand might be substituted with advantage for the common operation in the bend of the arm, in order to avoid pricking the nerves.

VENA CEPHALICA.—The vein of the back of the thumb running into a trunk, which takes a course over the outside of the wrist, is called CEPHALICA POLLICIS.

From this vein and the division of the plexus of the back of the hand, a considerable trunk is generally formed, which takes its course on the radial edge of the arm, and is called CEPHALICA MINOR, or RADIALIS EXTERNA. This vein in its tract over the extensor radialis, and the supinator longus, has many lateral communications, particularly with the median vein.

This vein, now joined by the median cephalic, and rising upon the outside of the humerus, is the GREAT CEPHALIC VEIN ; and it passes, first betwixt the biceps and triceps brachii, and then betwixt the deltoides and pectoralis major muscles. Several small cutaneous veins play over the belly of the biceps muscle, and communicate with the basilic vein ; a little below the external condyle of the os humeri, the cephalic vein detaches a branch which ascends betwixt the brachialis internus and supinator longus, and which afterwards forms inosculations with the basilic vein, on the back of the arm.

The great cephalic vein passing up betwixt the tendons of the pectoralis, major and the deltoid muscles, sinks into the axilla and joins the axillary vein.

VENA

VENA BASILICA *. We trace the origin of the bafi-
lic vein from thofe veins which, being continued from
the plexus, on the back of the hand, take their courfe
over the lower head of the ulna. (A confpicuous branch
of thefe veins, from the little finger, was called SALVA-
TELLA † by the ancients.) From this origin, the bafilic
vein takes a fpiral courfe on the ulnar edge of the fore-
arm, fometimes in one great trunk, oftener in two,
fometimes in a plexus of veins ; here it may be called
ULNARIS SUPERFICIALIS, or CUBITALIS INTERNA.
This vein, now rifing before the inner condyle of the
humerus, paffes on the inner margin of the biceps
flexor mufcle ; here it forms very free and numerous
connections with the internal or brachial vein, the fa-
tellites and cephalica ; now paffing up, until it finks by
the outfide of the tendon of the pectoral mufcle, it joins
the axillary vein.

The great bafilic vein, or the great trunk, after it has
afcended above the elbow, and received the median ba-
filic, is joined by feveral deep branches of veins, as
thofe which accompany the brachial artery, called fa-
tellites or comites, a vein which is called profunda
brachii ; and ftill nearer its termination, it receives
the addition of the *vena fub-humeralis*, or *articularis*,
and the *venæ fcapulares*, viz. thofe anfwering to the ar-
teries of that name.

VENA MEDIANA MAJOR ‡.—This is a vein which runs
up the middle of the fore-arm, beginning from the
plexus of veins, which play over the flexor tendons,
and come from the ball of the thumb ; it is a vein which
is very irregular, being fometimes double, and fome-
times rather in the form of a plexus, than to be con-

* *Brachialis.* The ancients termed the bafilic vein of the right
arm, the vein of the liver, or *vena hepatica brachii*, and that of the
left, the *vena fplenica brachii*.

† *Salvatella quafi Salvator* being opened as a fovereign remedy in
Melancholia.

‡ *Vena Media ; vena fuperficialis communis. Fabricii fig. brachii
viva.*

fidered

fidered as a regular trunk; often it is particularly fhort, and can be confidered as a trunk, only for a few inches as it approaches the bend of the arm ; not unfrequently it is entirely wanting, and, as if annihilated by the greater fize of the branches of the cephalic or bafilic veins. But, for the moft part, when this vein has afcended on the middle of the fore-arm, near to the bend of the arm it divides; one branch paffes obliquely outward, and joins the cephalic vein, the other inwards and unites with the bafilic vein; the firft is of courfe the MEDIAN CEPHALIC VEIN *, the fecond, the MEDIAN BASILIC VEIN.

These are the two branches which the furgeon moft commonly felects for bleeding. Around the median cephalic, the cutaneous nerves play more profufely, and under the median bafilic vein the humeral artery paffes. It is by the awkward plunging of the lancet into the median bafilic, that the country bleeder fometimes produces the aneurifm of the artery; but the dreadful fymptoms following the pricking of the nerve, are more frequently produced by bleeding in the median cephalic ; cafes however occur of the pricking of the nerves, while bleeding in the median bafilic vein.

AXILLARY VEIN.—The trunk of the veins of the arm paffes through the axilla, until it arrives betwixt the firft rib and clavicle, under the name of axillaris. Here lying by the fide of the artery, it receives many mufcular branches from the flefh of the fhoulder, the external and internal fcapular veins, and the thoracic veins ; in general where it paffes by the head of the humerus it receives the cephalic vein.

SUBCLAVIAN VEINS.—The axillary vein continuing its progrefs over the firft rib, becomes the fubclavian vein, and is joined by the external jugular vein. It then takes a direction downward, and being joined by the great internal jugular vein, and having received the trunk of the abforbent fyftem juft at the angle of the

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* Portio cephalica, A. B. loc. cit.

meeting

meeting with the great jugular vein, it terminates in the fu-
perior cava. On the right fide the fubclavian vein is
fhorter, and defcends more directly ; on the left it is
longer, but ftill its direction is downward and acrofs the
upper part of the cheft; paffing before the trachea and the
branches of the arch of the aorta, it joins the fubclavian
of the right fide, and together they form the fuperior cava.
Befides the jugular veins, the left fubclavian vein re
ceives thefe, a vein from the fhoulder and lower part of
the neck, the vertebral vein, with fome leffer plexus of
veins defcending from the neck, and the thyroid veins.
From below they receive the leffer internal thoracic veins,
and the mammariæ *.

SECTION III.

THE SUPERIOR VENA CAVA, THE VENA AZYGOS, AND LESSER VEINS OF THE THORAX.

THE fuperior vena cava is the trunk of all the veins of
the head, neck, arms, and of the parts in the thorax ;
foon after it is formed by the fubclavian veins, it is joined
by the vena azygos, and receiving the INTERNAL MAM-
MARY VEINS, and the VENÆ THYMICÆ, and PERICAR-
DIAC branches, the INTERCOSTAL and BRONCHIAL
veins, it defcends into the pericardium, and dilates or
opens into the right finus or auricle.

VENA AZYGOS †. This is the principal vein of the
thorax, and chiefly of the walls of the thorax. It is ob-
ferved to take its origin upon the vertebræ of the loins
from fome of the lumbar veins, or by inofculations with
the renal, fpermatic or leffer branches of the abdominal
cava, receiving the firft and fecond lumbar veins, as in
its afcent in the thorax, it receives the intercoftal veins

* *Haller, Icon. Anatomic. Corporis humani Fafciculus* III. *tab.
arter. Pectoris.*
† *Sine pari.*

on

on either fide * ; afcending betwixt the crura of the dia-
phragm, and by the fide of the aorta, it fometimes re-
ceives the lower phrenic veins ; in the thorax lying on
the right fide of the bodies of the vertebræ, and before
the intercoftal arteries, it receives the bronchial veins
from the root of the lungs, and from the trachea it
receives the veins of the pofterior mediaftinum and œfo-
phagus ; through the intercoftal veins, it communicates
with the external and internal mammary veins, and with
the venal circles of the fpinal marrow.

Upon the third vertebra, the azygos vein feparates
from the fpine, and with an arch, and bending round the
root of the lungs, it opens into the fuperior cava, juft
where it is about to enter the pericardium : where it opens
into the great vein, it is guarded by a valve.

This vein however, like moft others, has confiderable
variety, and does not always merit the name of azygos,
for fometimes it is double, a divifion afcending on the left
fide of the fpine, and uniting with the branch of the
other fide, juft as it is about to enter into the fuperior
cava.

OF THE LESSER VEINS IN THE THORAX.—The VE-
NÆ MAMMARIÆ take a courfe by the fide of the internal
mammary artery, and require no defcription. Like the
arteries, they fpread their branches on the mufcles of the
belly, and communicate with the diaphragmatic and lum-
bar and epigaftric veins. The left mammary vein termi-
nates in the left fubclavian vein, the right in the fuperior
vena cava.

THE VENÆ THYMICÆ enter, either into the union of
the fubclavian veins, or they enter into the guttural veins,
or the internal mammary veins.

THE PERICARDIAC VEINS gather their branches
from the pericardium, from the aorta, trachea, and lym-
phatic glands ; they fend down branches by the fide of
the phrenic nerve, which inofculate with the veins of the
diaphragm ; they enter the internal mammary vein, or

* We except fome of the veins from the interftices of the higher
ribs, particularly on the right fide, which enter the fubclavian vein.

the

the fuperior cava, or the terminations of the right fub-
clavian.

THE SUPERIOR INTERCOSTAL VEINS.—The right
and left intercoftal veins differ in their fize and diftribu-
tion ; the right is fmall, and receives only one or two of
the upper intercoftal veins, which do not enter into the
azygos vein.   The vein of the left fide begins even fo low
as the interftice of the feventh rib ; it receives branches
from the pleura, pericardium, and lungs (viz. the bron-
chial veins) and from the œfophagus; they enter the
fubclavian veins.

CHAP. II.

OF THE VEINS WHICH UNITE TO FORM THE INFERIOR VENA CAVA.

THE inferior vena cava receives the veins of the
lower extremities, the hypogaftric and abdominal
veins, and the veins of the vifcera of the abdomen ; but
thofe of the membranous contents of the abdomen are
received by it only indirectly, and through the circula-
tion of the liver.

OF THE VEINS OF THE LEG AND THIGH.

WE have obferved that the veins of the extremities
are in two fets ; the deep and fuperficial.   In the leg and
thigh, the deep-feated veins accompany the arteries, and
receive the fame name: the cutaneous veins are the
faphena major and minor.

SAPHENA MAJOR *.—A large and beautiful plexus of
veins is formed on the fore-part of the foot, and com-
ing from the back of the toes, and outfide of the foot.
Two principal veins arife from the arch which thefe
form : one takes the courfe behind the inner ankle, and

* Saphena magna, interna.

is

is the faphena major; the other paffes over the outer ankle, and forms the faphena minor.

The great faphena may be traced from the great toe, from the infide of the foot, and behind the ankle: it receives one or two branches from the fole of the foot. Sometimes the principal branch paffes behind the lower head of the tibia, fometimes before it, or it forms circles here: a little above the ankle a vein from the middle of the metatarfal arch comes obliquely over the tendon of the tibialis anticus, and joins it.

The faphena, now a confiderable trunk, runs up the leg before the inner margin of the belly of the gaftrocnemius mufcle, and on the inner ridge of the tibia. In this courfe it receives numerous cutaneous branches, and backward, over the belly of the mufcles, it forms inofculations with the leffer faphena. From the infide of the leg the trunk afcends on the infide of the knee, where it receives feveral branches, coming round the joint, and over the head of the tibia. Now paffing fomewhat obliquely, it afcends upon the thigh, and at the fame time, turns from the infide to the fore-part of the thigh. In the thigh the great faphena receives many branches, and is not always a fingle vein: for fometimes the branches collecting form a fmall trunk, running collateral to the greater vein, and which joins it in the groin. In all this courfe the faphena vein is fuperficial and lies imbedded in the cutaneous fat; with but a very flight and imperfect aponeurofis inclofing it; while it is external to the proper fafcia of the leg and thigh. As it afcends upon the thigh, however, it does not dive fuddenly under the fafcia; but is gradually enveloped and embraced by the condenfed cellular membrane and fafcia.

When it was more the practice than at prefent to bleed in the ankle, the faphena major was the vein felected: but as in all the courfe of the vein, from the great toe to the knee, it is connected with the nerve which bears its name, there are not wanting inftances of thofe bad effects from pricking of this nerve, which not unfrequently follow the bleeding in the arm.

SAPHENA

SAPHENA MINOR *.—This vein arifes from the
plexus on the outfide of the dorfum pedis : it runs over
the outer ankle and above the fafcia, covering the tendons
of the peronei mufcles. Here receiving many branches
and forming frequent deep inofculations, it mounts
on the outfide of the vagina or fafcia, which covers the
back of the leg, until arriving betwixt the hamftring
tendons it finks into the popliteal hollow, terminating
in the popliteal vein.

The other veins of the lower extremity which ac-
company the arteries in their courfe, need little de-
fcription.

ANTERIOR TIBIAL VEIN.—The veins accompanying
the anterior tibial artery form many inofculations, and
when minutely injected, almoft conceal the artery.
They are the anterior tibial veins, and only unite into a
trunk, where perforating the interofleous ligament it
joins the popliteal vein.

POSTERIOR TIBIAL VEIN.—In the fole of the foot we
have the external and internal plantar veins, which
uniting into trunks, accompany the artery behind the
inner ankle. In its courfe betwixt the foleus and the
tibialis anticus mufcles, it cannot be called the pofterior
tibial vein ; for it is a mere net-work of veins furround-
ing the pofterior tibial artery. It receives, near its ter-
mination, a branch called SURALIS, from the gaftroc-
nemii and foleus : it terminates in the popliteal vein.

THE VENÆ PERONEÆ, are the venæ comites by
the tibial artery, and are two or three in number.
All thefe veins have free inofculations with each
other.

THE POPLITEAL VEIN.—This vein is formed by the
three divifions of deep veins accompanying the arteries
of the leg, and the faphena minor. It lies more fuper-
ficial than the artery, and feems to cling round it. As
it afcends, however, it twifts round the artery, the ar-
tery being neareft the bone—a little above the joint it
receives the lefler faphena.

* *Vena faphena parva externa.*

This

This vein, perforating the tendon of the triceps, comes to the fore-part of the thigh, ftill united to the artery: it is now the CRURAL VEIN. As it afcends it gets from behind the artery, fo that in the groin it lies nearer the pubes than the artery does: oppofite the trochanter minor it receives the internal and external circumflex veins, and the VENA PROFUNDA FEMORIS. About an inch below Poupart's ligament the crural vein receives the faphena major, and the fmall external pudic veins.

EXTERNAL ILIAC VEIN.—The femoral vein lying on the infide of the artery or nearer the pubis, enters the abdomen under the femoral ligament, and paffing by the fide of the Pfoas mufcle becomes the external iliac vein. It receives feveral lefler veins juft within the ligament, particulaily the epigaftric vein from the mufcles and integuments of the belly, and the veins accompanying the arteria circumflexa ilii. The external iliac vein is joined by the HYPOGASTRIC VEIN which afcends from the pelvis. It requires no minute defcription; it anfwers to the diftribution of the hypogaftric artery. This, which is the internal iliac, joining the trunk from the thigh, forms the COMMON ILIAC VEIN.

VENA CAVA ABDOMINALIS *.—A little lower than the bifurcation of the aorta, the right and left common iliac veins unite. By this union they form the vena cava. This vein afcends upon the right of the aorta. It receives fewer branches than would naturally be imagined, becaufe the veins of the vifcera take their courfe by the porta into the liver. It receives the lumbar veins, the fpermatic veins, the renal, fuper-renal, and phrenic, veins. Paffing upward it is received into its appropriate fofla in the liver, and feceding a little from the fpine it receives the VENÆ CAVÆ HEPATICÆ and perforates the diaphragm; entering the pericardium it expands into the great finus, or right auricle of the heart †.

RENAL VEINS ‡.—Thefe veins are lefs irregular than

* Vena Cava inferior.
† Vena Cava lufus. Act. Petrop. tom. xii. p. 262. Sandifort Thef. vol. i. p. 348.
‡ Emulgent veins.

the arteries of the kidney, which relation of the veins and arteries is uncommon. From the relative fituation of the kidneys to the cava, it is evident that the right vein muft be fhort; the left comparatively longer, and taking a courfe from the kidney over the aorta *.

SUPRA-RENAL VEINS.—Thefe little veins are like the arteries in their courfe. The right one enters fometimes into the vena cava, fometimes into the renal vein. The left fometimes receives the phrenic vein of that fide and enters into the renal vein.

SPERMATIC VEINS.—The veins of the tefticles return from the minute extremities of the fpermatic artery, diftributed in the body of the gland and in the epidydimis. As thefe veins reach the cord they become very tortuous, and encircling the convolution of the fpermatic artery, form a thick vafcular body. The higher thefe veffels are, the nearer to the ring, the lefs convoluted they are, which makes the cord of a pyramidal fhape. This is moft remarkable in brutes; and in them chiefly have thefe veffels got the name of CORPUS PAMPINIFORME †.

The fpermatic vein before it enters the abdomen, has collected the principal branches and is fortified with valves. Thefe valves, however, fometimes lofe their office in confequence of dilatation of the veins, and then comes a very unpleafant varicofe fwelling of the fpermatic cord.

The fpermatic vein courfing round the loins, gathers branches from the fat of the kidney, the ureter, &c. The right vein is generally double, the left fingle; the one joins the cava, the other the emulgent vein.

* The Renal veins, however, fometimes vary in their number, the right being double or triple, the left even fometimes in four branches.

† Pampiniformis, i.e. refembling the tendrils of the veins. *Icon Anatomic. Corporis humani Fafciculus iii. tab. Arter. Pectoris.*

PART IV.

OF THE LYMPHATIC AND LACTEAL SYSTEMS OF VESSELS.

CHAP. I.

INTRODUCTORY VIEWS.

WE have underftood that the red blood circulates in the body, through veffels (the arteries and veins) which have a direct communication at their extremities by inofculation; that although thefe veffels lie parallel to each other, and extend from the heart to the remoteft part of the body, yet the blood is faid to pafs through the circulation, becaufe it is tranfmitted from the veins into the arteries through the cavities of the heart; and from the extremities of the arteries directly into the veins, returning again to the centre. In this tranfmiffion of the blood through continuous tubes, there is in the coats of the veffels an alternation of contraction and relaxation which impels it forward. But befides thefe arteries and veins carrying the red blood through the body, there are other pellucid veffels more remote in their connection with what is generally called the circulating fyftem.

SECTION I.

OF THE CAPILLARY VESSELS.

THE capillary veffels are thofe extreme branches which are as minute as hairs; but this, though the li-

teral, is not the general meaning of the term. By ca-
pillary veffels is rather underftood thofe branches in
which the changes are wrought from the blood, and
which are either fo minute as not to allow the promif-
cuous flow of the blood, or poffeffed of fuch a degree
of irritability and appetency, as only to allow certain
parts of that fluid to be tranfmitted.

It is proved that in the living body there is no exu-
dation; but no fooner is the animal dead, than the
fluids exude from the veffels, the fecretions pafs through
the coats of thofe receptacles which formerly contained
them, and parts partake of the colour of that which
is contiguous. From this fact, we are led to think that a
property exifts in the living fibre, which repels the fluids.
Admitting this, it is very natural to fuppofe that the
fibres, and more particularly the veffels in the capillary
texture of each organ poffeffes fenfibility, which has its
relations to the fluids paffing through them, or to be
fecreted from them.

If we admit this, we may alfo forefee the explanation
of the moft puzzling phenomenon of inflammation.
Inflammation is the effect of excitement: there is in-
creafed action of the arteries; and by the operation of
the fame caufe, there is a deftruction of the natural fen-
fibilities of the capillary veffels, fo that they no longer
are poffeffed of their diftinguifhing fenfibility, and they
admit the promifcuous paffage of the red blood; they
become dilated by the action of the arteries, and vifibly
diftended with red blood. The effect is not merely the
mechanical derangement of the particles of the blood.
The chemical changes which take place in the extreme
veffels are difordered, and the blood depofits upon the
extreme branches of the nervous fyftem an unufual pro-
portion of irritability; fo that with the rednefs arifing
from the circulation of red blood through the hitherto
pellucid veffels, in parts not endowed with fenfibility,
there is acquired an unufual fenfibility, and the power
of tranfmitting the fenfation to the fenforium. Since
we fee that in an inflammatory ftate the pellucid veins
tranfmit red blood, and that this red blood muft be

supplied

supplied by the serous arteries; then it is proved that answering to the pellucid arteries (in their natural state) there are pellucid veins. We acquiesce therefore in the opinion that supposes both the arteries and veins to have pellucid capillary branches answering to each other, collateral to the larger and more evident anastomosis of their red extremities. These anastomosing branches of the arteries and veins in which the red blood is seen to circulate, perpetuate the flow of the greater part of the blood back to the heart, while the several secretions are performed in the capillary vessels; but there is no reason to suppose that the fluids sent from the arteries into these pellucid capillary vessels are all poured out in form of secretions: part returns into the extremities of the circulating veins. The secreted fluids and solids are either carried away by ducts into their receptacles, or thrown out from the body: while those fluids which are exuded on the cellular membrane and cavities are re-absorbed by the system of absorbing lymphatics.

We say then that arteries terminate, first, in red veins; which is proved by the microscope, and by mercurial and other injections; secondly, in glands; thirdly, in cells receiving red blood; fourthly, in lymphatic veins; fifthly, in exhalents, which pour their fluids into the cellular membrane, cavities, joints, &c. and which fluid is taken up by the valvular lymphatic absorbents.

But these absorbent vessels, of which we are now to treat under the division of lymphatics, do also perform a circulation, in as much as they convey back to the centre of the system the fluids, which have been thrown out from the extremities of the arteries. But as these lymphatic vessels are not continued from the extremities of the arteries as the red veins are, as they imbibe the fluids, which have been thrown out of the other system of vessels; their fluid contents cannot be conveyed through them by the force of the heart and arteries, these vessels must be peculiar in having powers within themselves, first of absorbing, and then of propelling their fluid onward to the heart.

The

The LACTEALS are veſſels which, diſtributed to the inteſtines, abſorb and convey into the ſyſtem the milky opaque fluid which is generated in the inteſtines by the proceſs of digeſtion.

The common property of abſorption in the lymphatics, abſorbents, and lacteals, and their being connected with the ſame trunk, occaſions their being conſidered as one ſyſtem of veſſels ; looking upon the general œconomy of the living body, we find them miniſtering to very different purpoſes. The one branch of the ſyſtem, the lymphatics, conveys it again into the circulating ſyſtem. The lacteal veſſels on the contrary, are thoſe veſſels which opening upon the inner ſurface of the inteſtines receive into them the nutritious fluids, prepared by the organs of digeſtion, and ſuited to ſupply the inceſſant waſte and deſtruction of the ſolid and fluid parts of our frame, which have been abſorbed and carried away by the lymphatics. Following this ſimple view, although the abſorbent ſyſtem be commonly divided into the thoracic duct, lymphatics, lacteals, and glandular apparatus attached to them, I ſhall throw the preſent ſection into the diviſions of the lymphatics and of the lacteals.

S E C.

SECTION II.

OF THE LYMPHATIC SYSTEM IN PARTICULAR.

THE lymphatic veffels are tubes whofe coats are perfectly pellucid, having a remarkable power of contraction, which caufes them to fhrink, and difappear, fo as to render it difficult to demonftrate them. Indeed they are only to be obferved by an eye accuftomed to make lymphatic injections. They are called LYMPHATICS, or DUCTUS AQUOSI, from their tranfmitting a fluid colourlefs as water. When they are diftended with their fluids, they fhew that they poffefs a very diftinct character from the other veffels. They are irregularly diftended, knotty, and fometimes like a chain of beads, or little irregular veficles connected together. This irregularity is owing to their numerous valves, which are femilunar membranes, like thofe of the veins, hung acrofs their cavities, fo as to catch and interrupt the reflu-

EXPLANATION of the PLATE.

I. The appearance of a lymphatic, injected with mercury, and diffected out. *-* point to the two moft perfect valves of this veffel.

II. A lymphatic gland injected with mercury, and diffected out. A. The gland apparently confifting of many veficles or cells. P. The lymphatic entering the gland. T. Lymphatics emerging from the gland.

ent

ent lymph*. They fay, in general, that in the fpace of
an inch the lymphatic veffel has three or four pairs of
valves. But this bears no certain proportion ; for as
thefe veffels run where they are expofed to occafional
compreffion from the furrounding parts, or bear the
weight of a high column of fluid, their valves are more
frequent. The lymphatics are improperly called cylin-
drical tubes, fince they are irregular from their valves,
branching, and frequent communications. The coats of
the lymphatic veffels are the ftrongeft of any in the body ;
for although extremely thin and pellucid, they give re-
fiftance to diftention beyond a certain point, and bear a
column of mercury which would burft through the valves
of veins, and tear the coats of arteries. If there be a
mufcular coat, and no one ever denied the mufcularity of
the lymphatics, then we may reckon three coats : Firft,
The inner coat, which is the continuation of the inner
tunic of the veins, as may be obferved in the opening of
the thoracic duft into the left fubclavian and left jugular
veins. It is fmooth and polifhed, forms duplicatures or
valves, and prevents the tranfudation of their fluids : it is
connected by cellular membranes to the middle coat.
Secondly, The mufcular or middle coat, which confifts
chiefly of mufcular fibres, which, according to Sheldon,
run in every poffible direction, though the greater number
take the circular direction. And, laftly, the outer coat,
which is connnected with the general invefting cellular
membrane. As the inner coat muft chiefly form the
valves, and as the valves poffefs fo wonderful a power of
refifting the column of mercury, I conceive that the
inner coat is that on which the ftrength and refiftance
to diftention of the lymphatics depends, though it has
been faid that it is to the outer coat that they owe this
property. The mufcularity of thefe veffels is rather in-
ferred than proved : it is inferred from the unaffifted ac-
tion which they have to perform in preffing the abforbed
fluids onward to the heart. Neverthelefs we fometimes

* *Ruyfchi Dilucidatio Valvularum.* Vet. Oper. Vol. i.

fee

fee the lymphatics of the lower extremities of a colour fo red and flefhy, that we may fay their mufcularity is demonftrable.

The lymphatics feem to poffefs little elafticity; when they are blown into, they rife with the flighteft force, and remain diftended, although the paffage of the air forward be uninterrupted; whereas, had they confiderable elafticity, they would contract and difappear. Indeed, when empty, in the dead body they may be rather faid to be collapfed than contracted.——Although the lymphatics can be diftended with the flighteft inflations, yet when diftended, as we have already obferved, they firmly refift further dilatation. This is a quality neceffary to their valvular ftructure, for if they were elaftic beyond this degree of dilatation, the calibre of the veffel would be occafionally fo enlarged as to render the valves incapable of meeting, and of preventing the retrograde movement of the fluids.

SECTION III.

OF THE GLANDS OF THE ABSORBENT SYSTEM.

EVERY where throughout the body and vifcera betwixt the extreme branches of the abforbent fyftem and the trunk, glandular bodies are interpofed. Though of various forms they are generally of an oval fhape, and they vary in fize from the twentieth part of an inch to a full inch in diameter. Sometimes they are fegregated,—fometimes accumulated and cluftered together. The colour of thofe bodies is various in the feveral parts of the body: in young animals they are redder, and become pale only with age. They are redder and ftronger in the outer parts of the body, as in the thigh, axilla, &c. lefs fo within the abdomen and thorax. 2. The latter will not bear fo high a column of mercury as the former.

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The mefenteric glands are faid totally to difappear in old age*.

It would appear that the glands of this fyftem are of more importance to young animals than to adults. In the fœtus and in children the lacteal and lymphatic glands are exceedingly numerous; but they fhrink or difappear with old age. In the fœtus, they can be of no very effential ufe; they are then rather in a ftate of preparation for the actions neceffary in infancy and youth. It is then alfo that they are moft liable to difeafe, and feem more irritable and ready to inflame, efpecially in fuperficial fituations. About the age of fourteen or fifteen this difpofition is changed, which is commonly faid to proceed from the increafed vigour of the conftitution, and the change which then takes place on the organs of generation. It is rather to be attributed, however, to the diminution of irritability and activity of the veffels of the glands at this age, for as we have faid, the glands are now fmaller and paler. We may further obferve that the lymphatic glands, even in the fcrophulous difeafes, are feldom primarily affected: that they partake of difeafed action from the furface, or from an affection of the inteftines, or from the abforption of matter. The ftructure of thefe glands has not been fatisfactorily inveftigated; or the inquiry is attended with infurmountable difficulties. Some anatomifts have faid, that they confifted of the convoluted abforbent veffels; others that they are of a cellular ftructure. When they affirm that thefe cells are totally diftinct from the lymphatic veffels, it is not fo eafy to underftand them : for cells communicating with each other, and into which the lymphatic veffels enter, are very much the fame with a feries of convoluted, varicofe, and irregularly dilated veffels. If we could diffect this feries of cells, as Haller did the veficulæ feminales, we fhould have reprefented to us the appearance of a convoluted varicofe veffel.

There is a coat of cellular membrane which furrounds

* By Ruyfch, Morgagni, Haller, Sheldon.

the

the glands. This coat is pervaded by a peculiar fluid which has given rife to fome fpeculation. It is obferved chiefly in young animals, and is for the moft part, though not always, white and milky, and in the glands of the lungs it is of a blackifh colour. This is the fluid which having globules in it, was fuppofed by Mr. Hewfon to be the firft ftage of the formation of the red globules of the blood. It is diftinct from the abforbed fluids, and is a fecretion from the arteries. Phyfiologifts have not determined the nature or ufe of this fluid.

At prefent there feems no better hypothefis to be offered regarding the ufe of the lymphatic and lacteal glands, than that they ferve to check, controul, and meafure the flow of the abforbed fluids into the mafs of the blood: without them it appears to me probable that at one time the lymph returning from the body, or at another time the chyle, might flow too rapidly, and in a difpropor- tioned quantity into the veins and heart. But by the check which the glands impofe upon this flow, giving a remora, and ferving as receptacles of the abforbed fluids, the fluids are poured with a more uniform and conftant flow upon the heart.

SECTION IV.

ORIGIN OF THE LYMPHATICS, AND OF THE DOCTRINES OF ABSORPTION.

THE lymphatics, forming a fyftem of abforbents, we might fay, in general, that they take up all the fluids which have been thrown out upon the furfaces of the body. Thus they arife from the pores of the fkin; from the furface of the cavities and vifcera covered by the pleura and peritoneum; from the cells of the inter- ftitial and adipofe membrane, &c. This is the fimple ufe affigned to this fyftem of veffels: but whether they are the only fyftem of abforbents; whether they carry
away

away all the parts of the fyftem, fluids, and folids;
whether they abforb the mufcles, membranes, bones,
tendons, &c. of which the folid body confifts, is a
queftion requiring fevere examination. It cannot be
denied that although the fyftem and doctrines of abforp-
tion be the moft beautiful and interefting, and apparently
the fimpleft in the whole œconomy, yet it is founded on
very few facts, while there is much doctrine tacitly ac-
knowledged, which feems in fymmetry with the facts and
the laws of the œconomy, but which is not founded in
abfolute proof.   We fhall firft examine the proofs of the
lymphatics being the veffels which abforb the fluids of the
cavities and furfaces of the body.   The animal machine
univerfally partakes of motion.   A principal provifion
for this mobility of parts, is the loofenefs of the cellular
membrane which every where pervades the body, and
fupports the veffels and connects the feveral parts.   This
interftitial membrane is elaftic, and being cellular, to
allow of motion, its furface is bedewed with ferous exfu-
dation.   This fluid is perpetually paffing from the extre-
mities or fides of the lymphatic arteries or capillaries, into
the cellular membrane, and upon all the cavities of the
body.   The fluid extravafated is called ferum, and fome
have fuppofed that it paffes through inorganized pores,
an expreffion that is not very intelligible; but if by this
is meant (as has fometimes been explained) " accidental
pores" in the fides of the veffels, it is a fuppofition quite
improbable and unlikely *.   The pores or veffels from
which this fluid exudes are called exhalent; and their
action is no doubt as completely fecretion as that which
produces the fluids, which in our wifdom we call more
perfect fecretions.

    That the lymphatics take up the fluids thrown out in

    * Dr. Hunter fupported this opinion (Commentaries p. 40,) viz.
" that the fluids of cavities were collected by tranfudation, and not
thrown out by exhalents;" an opinion which could only have arifen
from not correcting the ideas received in making injections in the dead
body by the phenomena of the living fyftem. See *Hewfon on the
Lymphatic Syftem*, chap. viii. where the opinion of inorganical filtering
is fuccefsfully combated.—See also Cruickfhanks.

                                                        the

the cavities of the body, as the abdomen, thorax, peri-
cardium, &c. there is what nearly amounts to an abfolute
proof, in comparing the fluids of thofe cavities with that
contained in the veffels; for by the experiments of Hewfon
it is found that if the fluid moiftening the cavities be col-
lected, it will form a jelly when expofed to the air, as
the coagulable lymphatic does. Again, if a lymphatic
veffel be tied up in a living animal, and then opened fo
as to allow the fluid to flow into a cup, it will alfo form
a jelly like the coagulable lymph*. The fluid of cavities
alters in animals difeafed; fometimes retaining its coa-
gulability, and even acquiring ftronger powers; fome-
times lofing it altogether. But what is moft effential to
our prefent purpofe, it has been obferved, that whatever
change takes place in the fluids of the cavities, the fame
is found to have taken place in the lymphatics.

But the ftudent naturally afks, how is the lymph
taken into the lymphatic veffels; and here it muft be
confeffed, there is too much field for conjecture.

It was thought formerly that the lymphatic arteries
terminated in fmall pellucid veins : thefe veins carrying
only the thinner, and refufing the red part of the blood,
were called lymphatics. When the anatomift threw in
his minute injection, and faw the coloured fluid return by
the red veins, and the colourlefs fluid return by the lym-
phatics †, it was held as a fufficient proof of the accuracy
of the preconceived notion, and tallied with obfervations
of Leewenhoeck, and the theory of Boerhaave. See in-

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* But, by difeafe, the fluids in the cavities and cellular membrane
is altered. In dropfy, for example, the fluid of the abdomen lofes
the property of coagulating on mere expofure ; it comes to refemble
more the ferum of the blood : this were fufficient proof that the
collection is not owing merely to the diminifhed abforption, but that
there is a change of action in the veffels of the peritoneum, pleura,
pericardium, &c. An inflammatory action of the veffels will throw
out a fluid more coagulable, and which, in a high degree of action,
will form a film of coagulable lymph or even pus on the furface. But
in a ftate the reverfe of inflammation, fuch for example, as the debi-
lity following inflammation, a ferous effufion will be poured out, hav-
ing little tendency to coagulate.

† It was probably Nuck who firft injected the lymphatics from
the arteries.

troduction

troduction to the account of the vifcera. When, however, anatomifts more carefully examined the ftate of parts, they found that the lymphatics were not filled, unlefs the cellular membrane was previoufly injected by the extravafation of the fluid from the blood veffels. Finding that this alledged experiment was really no proof of the anaftomofis, and direct communication betwixt the extreme arteries and lymphatics, they conceived that it was a proof that thefe lymphatics took their rife from the cellular interftitial texture. Then injecting with mercury, they found that when the veffels burft, and the column fuddenly defcended, and the cellular membrane was filled, the mercury was feen to rife in the lymphatics. Following up this, they blew air, or injected various fluids directly into the cellular membrane, and injected the lymphatics. Thus by an error, by an accidental effect of their injection, the minds of Dr. Hunter and Monro were opened to a freer difcuffion of the received opinions and approved authorities. Soon, however, it was underftood by thofe converfant with anatomy, that thefe accidental injections of the lymphatics did not prove the lymphatics to take their origin either from the cells or from the extreme arteries ; but already this good effect, at leaft, was produced, that men's minds were excited to enquire after new facts, and to follow a new train of obfervation. It was now recollected, that a ftrict analogy and correfpondence fubfifted betwixt the lymphatics and lacteals ; the proofs of the lacteals being abforbents, were recalled to memory ; new proofs of their being the fole abforbents of the inteftines were brought forward ; the nature of the fluids effufed into the various cavities and cells of the body was attended to ; and the conviction followed, that the moft effential ufe of the lymphatic veffels was to ferve as a fyftem of abforbents, to take up the extravafated fluids. They reflected that to diftend the inteftines with injection would never fill the lacteals ; and were convinced that the injection of the lymphatics could not be fuppofed to be through the proper abforbing mouths of thefe veffels opening upon the cells; but rather that the injection had entered the veffels by the rupture of their extreme branches.

branches. Thus the theory of the lymphatics being a system of absorbents, came to rest on analogy, and the observation of the phenomena of the living body.

The chief proof of the lymphatic absorption has been derived from the manner in which the venereal virus is received into the system. Venereal matter being allowed to lodge upon the delicate skin of the glans penis or preputium, causes an ulcer there. The matter of this ulcer is absorbed by the lymphatic of the part; an inflamed line is sometimes to be traced into the groin; and the lymphatic gland of the groin receiving this absorbed matter, inflames and forms the bubo. Here, then, is a proof that the red veins do not absorb, and that lymphatics do: else why are they inflamed?—and why are the lymphatic glands inflamed to suppuration?

We must observe, however, that there is here by no means an absolute proof of absorption of venereal matter. Although, therefore, we believe in the general system, we may hazard these queries:—If this matter is absorbed, why is there no infection without ulcer (chancre) of the glans? If this ulcer be produced by absorption, how comes it that the constitution is not infected by the first absorption of the matter, and before it has formed an ulcer? Is it not probable that the irritation of the venereal matter, lodging on this vascular surface, and without being absorbed, causes a peculiar inflammation, the tendency of which is to form a pustule, and to produce matter similar to that which originally infected the part with the specific and peculiar action? Again it will be said, however the venereal pustule was originally produced, it appears evident that the absorption of this matter, the conveying of it along the lymphatic, inflames the vessel, and the next lymphatic gland into which it enters, receiving the venereal matter, inflames and suppurates, &c. But again, I choose to say, with every show of likelihood, that neither is this a proof of absorption; but that the lymphatic vessel being very irritable, and always receiving its stimulus to action

from

from its extremities, it has partaken of the venereal in-
flammation ; that this inflammation has been propagated
to the gland ; that, the gland being formed of the con-
voluted lymphatic veffels, the effect of this inflammatory
action is there accumulated to fo great a degree as to
deftroy the function of the gland and lead to fuppura-
tion *.   And further, that the difeafe is received into
the conftitution only in confequence of the fyftem at
large partaking of the irritation (a word which but im-
perfectly expreffes the change) of the local action of
veffels.   Matter might be abforbed and taken into the
conftitution, and the difeafe propagated according to
the common explanation ; but, according to that offered
here, there muft be a primary and local difeafe, from
which the general affection is propagated.   If we are to
take the inflammation and hardening of the lymphatics
and axillary glans as a fymptom of abforption from a
difeafed mamma, we muft acknowledge the fame proof
in evidence of the veins abforbing : for although the lym-
phatics are more active, and their activity depending on the
ftate of their origins and extreme branches, and although
they be more liable to inflammation than the veins ; yet
are the veins affected in a way that would, on this proof,
as unequivocally prove them to be abforbents ; for we fee
how they enlarge around a difeafed breaft, become pro-
minent and hard, and lofe their foftnefs and elaflicity ;
how they fhew themfelves on the furface of a white
fwelling, or on a cancerous tumour.   But, as we would
not fay that this is a proof of abforption by the veins,
neither is the proof unequivocal that there is abforption
by the lymphatics.   Again, a fuppurating ftump, with
bad inflammation, will caufe inflammation of the lym-
phatics, and fuppuration in the glans of the groin † ; a

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* If a chancre be indolent, although matter be formed in it, no
bubo will be produced : but if the furgeon applies fome corrofive
dreffing, which, inftead of entirely deftroying the difeafed fpot, in-
flames it ; then will the gland in the groin fympathize and rife into
a bubo.

† See Hunter's Commentaries.

proof

proof of abforption of the matter of the ftump : but do we not find that from fuch a ftump the veins afcend, inflamed and fuppurating, while fometimes a chain of abfceffes is formed for a confiderable extent ? This, we can have no doubt, is the effect of the inflammation continued along the veffel ; and is not the inflammation produced precifely in the fame way in the lymphatic ?

I found my opinion of the lymphatics being abforbents,—firft, on the circumftance that their ftructure is adapted to this action ; fecondly, on the analogy between them and the lacteals, in which abforption is proved ; thirdly and laftly, upon their continuing to receive and tranfmit their fluids, after the heart and arteries have ceafed to beat, and the red blood to circulate : for then how can they act, but by their own powers ? How can they receive fluids, but by abforption ? Finally, this phenomenon fhews in the lymphatics, a greater degree of irritability, and ftronger principle of activity and tenacity of life, than actuates any other fet of veffels.

OF THE ABSORPTION OF SOLIDS.

On examining the works which within the laft forty years have contributed to throw light on this fubject, we at once acknowledge how neceffary it is for that part of a fyftematic book of anatomy, which profeffes to treat of abforption, to take the form of a critical inquiry. When the abforption of the fluids of the cellular fubftance, or in the cavities, was univerfally affented to, phyfiologifts did not make fufficient diftinction betwixt the abforption of the fluid thrown out of the influence of the circulating veffels, and that matter which continued to be involved in the membranes and veffels, and which formed the folid part of our frame. It will readily be allowed that the fluid thrown out upon the furfaces of the body and in the cells, might be abforbed without inferring that every part of the body, folids and fluids, were alfo taken up by the lymphatic abforbent veffels. But phyfiologifts obferving that the folid parts

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of

of the body were suffering perpetual change; that the whole body and the vessels themselves were formed, decomposed, and carried away; they hesitated not to attribute this to the deposition from the arteries, and the absorption by the lymphatics. This alternate destruction and renovation of parts, the perpetual change which the whole body suffers, has been universally acknowledged and attributed in part to the operation of the lymphatic system, without any other proof than a slight analogy.

The interstitial fluids, and the fluid in the cavities, is imbibed by the absorbing mouths of the lymphatics on the surface of the membranes; but where is the analogy between this and the destruction of solid parts? It has been said that the absorbents eat down the solids, and nibble like the mouth of a worm! a conjecture, the falsity of which is equal to its apparent absurdity. The solids are raised by the agency of the vessels on the chemical affinities of the circulating fluids. They must be resolved by their decomposition, reducing them again to the state of fluids; or the secreting vessels throw out fluids which dissolve them : an operation anterior to their absorption. From the comparative simplicity of the fluids of the circulating vessels, and that in the absorbents, we are authorized to conclude, that as from the blood the several secretions, solids, and fluids are formed; these fluids, before they are again taken into the active system of vessels, are resolved into their original simple and constituent parts. Thus we are not to look for the matter of the component parts of the body in the absorbing system of vessels more than in the blood, from which these parts were originally formed; nor are we at liberty to suppose that they are taken down by a process like eating or abrasion.

I conceive, that the absorption of the solids depends but in a limited degree on the agency of the lymphatics; and that there is a necessary change in the aggregation of the matter previous to the absorption by the mouths of the lymphatic vessels.

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EXAMINATION OF SOME OPINIONS OF MR. HUNTER ON
THE SUBJECT OF ABSORPTION OF SOLIDS.

MR. HUNTER fays that his conception of the matter
is, that nature leaves little to chance; and that the
whole operation of abforption is performed by an action
in the mouths of the abforbents. Phyfiologifts have
laboured, he obferves, to explain abforption on the
principle of capillary attraction, becaufe it was familiar;
but as they were ftill under the neceffity of fuppofing
action in the veffels after the matter was abforbed, they
might as well have carried this action to the mouths of
thefe veffels.

One never could have ventured to fuppofe the extra-
vagant conclufion to which this idea, once entertained,
has led Mr. Hunter.—He proceeds to confider the many
kinds of folids the lymphatics have to carry away, and
the variety of mouths in different animals, fuited to the
great variety of fubftances they have to work upon, and
then draws the conclufion, or leaves his reader to do fo;
that not only are the mouths of the lymphatics calcu-
lated to abforb fluids; not only do they carry away the
folids, but each veffel, according to the hardnefs and
toughnefs of the material upon which it has to operate,
has a mouth adapted for the work. Here we do not
fee the genius of Hunter, but a poverty of imagi-
nation.

Mr. Hunter takes the merit of a new doctrine relating
to abforption. He admits that oil, fat, and earth of
bones had always been confidered as fubject to abforp-
tion; and that fome other parts of the body liable to
wafte had been fuppofed to fuffer by abforption; but
that any folid part fhould be abforbed, he fuppofes to
be entirely a new doctrine. Now, I think we may
venture to affirm, that not only was it known that
folid parts of the body were taken away during life;
but that phyfiologifts knew each and every part of the
living body to be undergoing a perpetual decay and re-
novation. Nay, we may venture further to fay, that

Mr.

Mr. Hunter did not comprehend, in its full extent, the relation in which the secreting and absorbing vessels stand to each other. He is fond of calling the absorbents, modellers,—" modellers of the original construction of the body,"—" modellers of the form of the body while growing."

Mr. Hunter could contemplate no change in the body during growth, decay, or disease, where there was an alteration of form or quantity of matter, without attributing it to the " modelling absorption."—A bone cannot be removed without absorption; nor a part which is useless to the œconomy (as the alveoli of the teeth, the ductus arteriosus, the membrana pupillaris, the thymus gland) diminished in size or totally carried away, without the absorbents being in action. This is undoubtedly true; but in regard to the manner in which it is performed we cannot agree with Mr. Hunter. When it becomes necessary that some part be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation. This is the only animal power capable of producing such effects; and like all other operations of the machine, it arises from *stimulus* or irritation, &c. On the contrary, I conceive that the absorption of parts in the natural action of health or in disease, is not owing to increased stimulus, but often to a diminution of it.

Does it not strike us forcibly that when a gland swells, and leeches and blisters are applied, and it subsides, this can be no means of exciting absorption; that when pressure is made on a part, and that part is absorbed, this is a strange way of stimulating? Or, when we bleed, is it not odd that this should give new power to the lymphatic system? For these are the means of giving a counter irritation, and of suppressing action.

Mr. Hunter has given to the lymphatics not only the grovelling qualities of animals, as eating; but the higher attributes of intellect. They do nothing without fore-

4   thought

thought and intention; when they abforb, it is becaufe they have found the parts ufelefs in the œconomy. He has carried this notion fo far, that he does not only fpeak of the abforption of the thymus gland, membrana pupillaris, alveoli of the teeth, &c.; but of the body in fever as a confequence of its becoming ufelefs when under difeafe!—The following may perhaps appear to be the more natural fuppofi.ion.

In a living body we may obferve the agency of the nervous, vafcular, and abforbing fyftems: and the phenomena of life are not to be attributed to any one, but to the whole of thefe. We muft alfo obferve, that life, or the mutual action of parts producing the phenomena of life, is proceeding from exc'tement, and as in the whole fyftem, fo in the individual parts of the body, the healthy action depends on the influence of this excitement to action. The tendency of the growth of the body to peculiar forms, and the increafe of parts in difeafe are produced by it. It acts upon the vafcular fyftem in difeafe, by producing increafed action and fecretion; as a mufcle, in the ufe of frequent and ftrong action, will become more flefhy and vafcular; as a gland, will be excited to greater action and more profufe difcharge, whilft it enlarges and fwells up. When a part enlarges in confequence of the ftimulus to increafed action, either arifing from the natural law of the conftitution or from difeafe, it proceeds from the fecreting veffels.preponderating over the abforbing veffels. There is a depofition of matter which the latter are unable to take away. But diminifh this action of the arteries, or take away their excitement, or caufe an excitement of fome neighbouring part, and thereby fubdue their action, relieve them of their fulnefs, and the abforbents regain their proportioned actions, and the fwelling fubfides. The parts of the body, which in the natural changes from youth to age, are abforbed and carried away, are thofe in which there is no longer the ftimulus to vigorous action, and of courfe the lymphatics overcome the power of the fecreting veffels, and

the

the part gradually diminiſhes, loſes its apparent vaſcu-
larity, loſes its redneſs, and is at laſt totally abſorbed.
And as the tooth of a child lies long hid under the jaw,
where it partakes of the ſtimulus to the action of its
veſſels, grows, and riſes up, and the alveoli, partaking
of this natural excitement, alſo form around it ; ſo
when the tooth decays and falls out, the alveoli will alſo
decay and be abſorbed ; becauſe the moment theſe veſſels
have ceaſed to partake of the increaſed action, their ab-
ſorbents, though acting with no greater powers than
formerly, do yet ſo preponderate, that a gradual waſting
is the conſequence.   Thus we have to conſider, not the
action of the abſorbents merely, but the relation which
their action has to that of the arteries.

I ſhould conclude that a part which has ceaſed to be
of uſe in the œconomy and is abſorbed, has not been
carried away by the ſtimulus applied to the modelling
lymphatics ; but in conſequence of a want of the uſual
excitement of the parts to action, and of the conſequent
preponderance of the action of the lymphatics ; not by
an increaſe of their action, but by a greater uniformity
of action, leſs dependent on the ſtate of excite-
ment of the part.   This more uniform ſtate of action,
or leſſer degree of dependence on excitement, will not
be denied when we ſee them continuing their action after
the death of the animal, and after the other phenomena
of life have ceaſed.   As to the abſorption of the body
in general from diſeaſe, as in fever, it appears to be
ſimply the effect of the continued abſorption, while nei-
ther the organs for digeſting and aſſimulating new
matter, nor the vaſcular ſyſtem for conveying the fluids,
are in a ſtate to miniſter to the wants of the ſyſtem,
but ſuffer under an unuſual irritation, which diſorders
their function.

We ſpeak very commonly of ſtimulating the lym-
phatics to abſorb by mercury ; for example—There may
be a ſpeck on the cornea, corroſive ſublimate is
given to excite abſorption.   The practice is good, but
ſurely this is the language of an erroneous theory.   An

6   inflam-

inflammation from general diforder of the fyftem or of the vifcera has taken place, where it is moft of all likely to take place, a courfe of mercury corrects this difpofition; the caufe removed, the inflammation fubfides, and with that the fpeck. The fame argument fuits the phenomenon when a tumour or enlargement of a vifcus is diminifhed, better than to fay that the mercury excites the lymphatics to the abforption of the tumour.

As to preffure caufing abforption and producing the wafting of parts, I cannot agree with Mr. Hunter in fuppofing that the lymphatics are here excited to action; but fhould rather infer that the nerves of the parts being benumbed, and the action of the arteries fuppreffed, the lymphatics continue to do their office, while the arteries are prevented from depofiting new matter.—For example, when we fee a curvature of the fpine, from a habitual inclination of the body to one fide, and confequently greater preffure on the one fide of the bodies of the vertebræ: it is natural, at firft fight, to fay, fince the one fide of the vertebræ is of its natural depth, and the other diminifhed, that the fide which is deep has remained, but the other fide has been abforbed; but, when we inquire further into the phenomenon, which has taken place, we recollect that the matter of bone is undergoing a perpetual change, and that the matter of both fides of the vertebra is changed; we fee that the preffure may not have excited the veffels to greater action fo as to caufe abforption; but that the preffure has prevented the depofition of new matter, when the old was taken away in the natural routine of the fyftem.

Mr. Hunter has affigned five caufes of abforption, which I conceive may be very naturally refolved into one.— Thefe are, 1, parts being preffed; 2, parts being irritated; 3, parts being weakened; 4, parts being rendered ufelefs; 5, parts becoming dead: of the firft we have already fpoken; the fecond I fhould deny, unlefs when it refolves into the third; for irritation does not caufe abforption, unlefs when it is to an extent fufficient to deftroy the natural action and weaken the part. The

third

third and fourth come under the effect of the lofs of the natural and accuftomed ftimulus to action in the arterial fyftem, which of courfe gives a preponderance to the abforbents : of the fifth we can have nothing to add illuftrative of the living fyftem.

CHAP. II.

OF THE COURSE OF THE LYMPHATICS.

THE lymphatics, in their courfe and relation to the fafcia and mufcles of the extremities, bear a great analogy to the veins ; for there are two fets or grand divifions,—the DEEP LYMPHATICS which accompany the arteries in their branchings amongft the mufcles; and the SUPERFICIAL fet which accompany the external veins.

SECTION I.

OF THE FOOT, LEG, AND THIGH.   Even in the toes the fame diftinction of the origins of the lymphatics may be obferved, as in the limb.   For while a plexus covers the toes fuperficially, and runs up upon the foot with the veins, deeper branches accompany the arteries on the fide of the toes.   When we obferve the courfe and origins of the greater and leffer faphena vein, we cannot fail to underftand the courfe of the feveral fets or divifions of the lymphatics of the foot and legs.

From the toes, dorfum, and edges of the foot, the lymphatics climb up the leg in four claffes.   1. One takes a courfe from the root of the great toe and infide of the foot, over the tendons of the great toe and tibialis anticus tendon.   It then paffes on the infide of the tendon
of

of the tibialis anticus mufcle, and before the head of the tibia, following the principal branch of the great faphena vein ; and then continues its courfe in company with the faphena to the infide of the knee.   2. There is at the fame time a confiderable number of lymphatics, taking their origin from nearly the fame place, viz. the infide of the foot, and before the inner ancle ; but they take a different courfe on the leg from the laft clafs ; for they pafs behind the lower head of the tibia : they now attach themfelves to fome branch of the faphena vein, and join the former fet on the infide of the knee.   From this they afcend fuperficially above the fafcia to the glands of the groin.   3. From the outfide of the foot there afcend fe-veral lymphatics ; a divifion of which paffes before the outer ancle and acrofs the tibia to join the lymphatics, parafites of the great faphena vein, and here they fome-times form plexus and contortions ; others turn in behind the outer ancle, and join the branches accompanying the leffer faphena.

The lymphatics which turn round behind the outer ancle pafs on the outfide of the tendo Achillis ; and ac-companying the leffer faphena vein, fink into the popli-teal hollow.   Here they unite with the lymphatics which have accompanied the feveral arteries of the leg and foot, and particularly the pofterior tibial artery.

Popliteal glands.   The glands of the ham-ftring cavity are generally three in number, and very fmall. They receive the lymphatics, which pafs with the pofterior tibial artery and with the leffer faphena, and they of courfe fwell and become inflamed in confequence of fores on the calf of the leg, outfide of the foot, and fole of the foot.

From the popliteal glands there afcend two large lym-phatics, which accompany the popliteal artery and venæ comites, and afcend with the latter through the adductor magnus to the fore-part of the thigh.   They run irregu-larly, or form a kind of net-work round the great veffels. On the fore-part of the thigh, and ftill deep, they (or at leaft fome of the principal trunks) enter the lower and

deep

deep inguinal glands, or emerging, they pass into the outward glands of the groin.

Sometimes these deep lymphatics, instead of being accumulated into larger trunks, divide into many branches, and only unite in the glands of the groin.

INGUINAL GLANDS. The inguinal glands are in number from five to ten; they lie involved in cellular membrane on the outside of the femoral ligament. Some of them are superficial and moveable under the integuments; some involved in the laminæ of the fascia, descending from the abdominal muscles; some are close on the femoral artery and vein, and under the fascia. Nearer to the pubes may be observed a division of these glands which belong to the lymphatics of the penis, perineum, &c.

The greater cluster of glands on the top of the thigh becomes affected from disease of the integuments on the fore-part and inside of the thigh and leg; and of that part of the foot where the great saphena vein commences; nay, further, the inguinal glands swell from sores of the buttocks, about the anus and private parts. They will even swell from disease of the testicle; but this only by sympathy.

LYMPHATICS OF THE PARTS OF GENERATION IN BOTH SEXES. From the penis there run backwards two sets of lymphatics : superficial ones, which take a course to the groin; and deeper ones, which take a course along the arteries of the penis into the pelvis, or under the arch of the pubis. The superficial lymphatics are the cutaneous vessels, and take their origin from the prepuce, and it is these which, either absorbing the venereal matter of chancre, or sympathizing with the venereal action, form sometimes an inflamed line along the penis, and cause the bubo in the groin. But as there are two sets of lymphatics, the chancre may be in a place where the deep-seated vessels are the absorbents, and consequently the constitution is contaminated without any bubo in the groin; and indeed it has been observed, that a venereal ulcer of the prepuce will, in general,

general, produce bubo, when an ulcer of the glans will
not *. When the tract of the matter is through the
deep lymphatics which enter the pelvis from below, the
gland through which the veffels pafs, is not inflamed to
form a bubo; neither do the lymphatic glands within the
ligament of the thigh inflame to the extent of forming a
bubo, either from chancre or from bubo in the groin.
This, fays a celebrated anatomift, Mr. Cruickfhanks, is
very fortunate; for if the external iliac glands, like the in-
guinal glands, fhould fuppurate, they could not be opened
by the lancet, they muft be left to themfelves; they
might burft; the pus might fall into the cavity of the
abdomen; might produce peritoneal inflammation; and
might probably deftroy the patient. Now, there appears
no reafon to dread any fuch cataftrophe. The matter of
thefe glands would form an abfcefs, which, like other ab-
fceffes in the track of thefe veffels, would fall down upon
the thigh. The fact, however, is curious; that when
the lymphatics difeafed enter one fet of glands, there will
be no bubo; when they take a courfe to the other, they
inflame and fuppurate. This I believe may be explained,
from confidering the pofition of the inguinal glands, as
being immediately under the fkin: for experience fhews
that a part near the furface will inflame and proceed to
fuppuration much more readily than a part deep-feated,
though fuffering from the fame degree of excitement.

In the external parts of woman (by Mr. Cruick-
fhanks's obfervation) there are alfo two fets of lympha-
tics. Thofe near the clitoris pafs up in a direction to the
ring; and thofe from the lower part of the vulva and
perineum to the glands of the groin.

LYMPHATICS AND GLANDS WITHIN THE LIGA-
MENT OF THE THIGH. The vafa efferentia of the
inguinal glands are in number from two to fix. The deep
lymphatics which accompany the femoral vein and artery,
lying under the cellular membrane, pafs under the liga-
ment, and foon form a large net-work of veffels accom-

* Cruickfhanks, page 138.

panying

panying the iliac veffels, in which they are joined by the branches of lymphatics from the fuperficial glands; fometimes the trunks accompanying the great veffels of the thigh pafs into a gland, immediately within the ligament; fometimes one or two of them only enter into the glands high in the loins; nay, fometimes a large veffel paffes on directly to the thoracic duct.

From fix to eight or ten glands are feated in the tract of the external iliac veffels, under the name of EXTERNAL ILIAC GLANDS. And upon the infide of the brim of the pelvis, and on the hypogaftric veffels, the glands are called the INTERNAL ILIAC GLANDS. In proportion to the frequency of difeafe in the pelvis, thefe external iliac glands, being in the tract of the lymphatics of the private parts and rectum, &c. are particularly fubject to difeafe. Thofe glands alfo which are called SACRAL GLANDS, as lying on the mefo-rectum, and in the hollow of the facrum, have been obferved to be often difeafed. On the pfoas mufcle, and on the loins it is impoffible to trace the veffels as fingle trunks; we may obferve that one net-work of veffels afcends upon each pfoas mufcle from the thigh; that there it is joined by the lymphatics of the pelvis. Thefe veffels are in a manner united by thofe which cover the prominency of the facrum, and pafs under the bifurcation of the aorta. The two GREAT LUMBAR plexus of lymphatics continuing their afcent, many of the veffels enter into the lumbar glands; and on the loins they are joined by the abforbents of the tefticle. By the union of the lymphatics afcending from the right and left fide, with feveral large trunks of the lacteals from the root of the mefentery, the thoracic duct is formed on the third and fourth vertebra of the loins.

OF THE LYMPHATICS OF THE ARM.

IN the arm, as in the leg and thigh, there are two fets of lymphatics:—the fuperficial and deep-feated. The firft of thefe accompany the cutaneous veins, the latter the deep arteries.

As

As in general there are two great veins on the fore-arm, the bafilic and cephalic veins; but particularly as the veins which gather into the bafilic trunk, on the inner and lower edge of the fore-arm, are the larger and more numerous clafs; fo it is found that the courfe of the more numerous clafs of lymphatics is on the lower and inner fide of the fore-arm, and that they accumulate about the bafilic vein.   Thefe are derived from the palm of the hand, and from the ulnar edge of the hand.   This fet fometimes paffes into glands, feated on the brachial artery, near the inner condyle of the humerus.

The abforbents which accompany the cephalic vein, arife from the fide of the thumb and fore-finger upon the back of the hand; they run on the radial edge of the arm, with the veins which afcend to form the cephalic vein. From the bend of the arm thefe veffels take a courfe on the outer edge of the biceps, and then get betwixt the inner edge of the deltoid, and outer edge of the pectoral mufcles; they then pafs under the clavicle, and defcend into the axillary glands.   This fet of abforbents receives the branches from the outfide of the arm in their whole courfe.

There are abforbents arifing from the back of the hand, next the little finger, which following fome of the branches of the bafilic vein (a larger branch of which is called the ulnaris externa) turn round the ulnar edge of the arm, are inferted into a gland, very commonly found before and a little above the inner condyle of the hu-merus.   From this gland a large lymphatic paffes up-wards, and attaching itfelf to the brachial artery, fplits and plays around it.

The deep feated lymphatics of the arm accompany the arteries in the fame manner as the venæ comites do; in general two with each artery.   They all terminate in the glands of the axilla, and can require no particular de-fcription.   The lymphatics, from the mufcles and inte-guments on the back of the fhoulder, alfo turn round and enter into the glands of the axilla.

The GLANDS OF THE ARM are fmall, and irregularly
<div align="right">placed</div>

placed in the courfe of the humeral artery, from the condyle to the axilla. They are from three to fix in number.

The GLANDS OF THE AXILLA are large and numerous; they receive the lymphatics from the arm, breaft, and fhoulder * ; they lie in the deep cavity of the axilla, formed by the tendons of the pectoralis major, and latiffimus dorfi mufcles. They are imbedded in a loofe cellular membrane, which, while it furrounds and fupports the veffels of the axilla in the motions of the joint, gives them ftrength from its elafticity. Thefe glands do not all furround the axillary artery ; but a lower clufter is attached to the branches of the fubfcapular artery, going forward on the fide of the cheft, and to the thoracic arteries. Thefe it is which, indurating from cancer of the breaft, require fo frequently to be extirpated. Thefe glands of the axilla greatly inlarging clofe upon the artery and plexus of nerves, fo as to preclude the poffibility of an operation ; they comprefs the veins and benumb the arm by preffure upon the nerves. When they fuppurate, they caufe a condenfation of the cellular membrane which furrounds them, and in confequence, a compreffion of the axillary nerves and a fhrinking of the arm.

When a wound or puncture, fuch as that which the ftudent of anatomy may receive in the diffecting room, has been made on the little or ring finger, the red lines which often appear in confequence of it, have taken the courfe of the ulnar edge of the fore-arm, and terminate in the infide of the arm, near the condyle; in fome inftances they have been continued even into the axilla. If venereal matter is abforbed at any part of the hand, near the little or ring finger, or by thofe fingers, the gland on the inner condyle of the humerus, or fome one in the courfe of the brachial artery, will moft probably inflame and form a bubo, and the furgeon will be aware of this

* " They even receive abforbents from the cavity of the cheft, and I have known them fwell from pleurify, peripneumony, and pulmonary confumption." Cruickfhanks.

abforption ;

abforption; but if the venereal matter be abforbed on the thumb or fore finger, it is poffible that it may not pafs into the glands until it comes into the infide of the clavicle. Thefe glands being out of our fight and feeling, the patient may be infected without the furgeon fufpecting it *.

LYMPHATICS OF THE HEAD AND NECK.

OF the abforbents of the brain, little is known precifely ; but none can deny the probability, next to an abfolute affurance and demonftration, that the arteries, veins, and lymphatics bear the fame relations in the brain as in the other parts of the fyftem. Lymphatic glands are obferved in the courfe of the internal jugular vein, and even in the foramen caroticum, which are underftood to belong to the lymphatics of the brain. The lymphatics of the head are to be obferved in the courfe of the temporal and occipital arteries ; the latter clafs terminate in glands, feated behind the maftoid procefs of the temporal bone. The lymphatics of the face have been obferved very numerous accompanying the facial and temporal arteries. But thofe from the internal parts of the face and nofe accompany the internal maxillary artery, and fall into the glands under the parotid, or in the courfe of that artery. Thefe glands are confequently liable to difeafe, from abforption of matter of abfcefs in the face, throat, and nofe, and their extirpation is a very hazardous operation. The lymphatics from the gums and jaws alfo accompany the internal maxillary artery, and emerge under the angle of the jaw ; and fome of them joining the external jugular vein, pafs through glands near the top of the fhoulder. The lymphatic veffels from the tongue and parts about the os hyoides, take alfo the fame courfe. To know the GLANDS about the FACE and JAWS are of the greateft importance to the furgeon, for nothing is more common

* Cruickfhanks, p. 182.

than

than the neceffity of cutting out indurated lymphatic glands. Thefe are fometimes miftaken for difeafed falivary glands ; now the falivary glands are rarely difeafed, the lymphatic glands often. And it will be a guide to the furgeon to enquire into the origin of the induration, (perhaps a fuppuration in the throat, nofe, or jaws,) and to know precifely the gland difeafed, its depth, and connections.

On the fide of the face, there are in general feveral fmall lymphatic glands, on the buccinator mufcle, immerfed in the furface of the parotid gland, and under the zigomatic procefs. There are alfo glands to be carefully noted, which lie under the tip of the parotid gland, where it extends behind the angle of the jaw, and alfo lying under the bafe of the jaw-bone, clofe to the fub-maxillary gland, and on the courfe of the facial artery.

The GLANDS and ABSORBENTS of the neck are very numerous, and the latter form an intricate and beautiful plexus, feveral branches of which are to be obferved accompanying the external and internal jugular veins. Some of the glands lie immediately under the fkin, and in the cellular membrane, on the outer edge of the platifma myoides ; many under that mufcle, and in the courfe of the external jugular vein. But there are many feated deep, for the greater number accompany the internal carotid artery, and internal jugular vein, or their branches.

The lymphatics of the THYROID GLAND have been raifed by Mr. Cruickfhanks, by plunging a lancet at random into the fubftance of the gland, and blowing into it, or throwing quickfilver into its cellular membrane. The trunks of thefe lymphatics join the thoracic duct on the left fide ; and on the right fide the right trunk, juft as it is about to enter into the veins.

OF THE TRUNKS OF THE ABSORBENT SYSTEM.

THE larger and proper trunk of the lymphatic fyftem, is generally called the THORACIC DUCT, becaufe it was
firft

firſt obſerved by Pecquet * to be a veſſel which con-
veyed the chyle through the diaphragm, and which
took its courſe through the whole length of the thorax,
to throw its fluids into the veins ,near the heart.   Be-
fore his time the lacteals which were diſcovered by
Afellius †, were ſuppoſed to terminate in the liver. The
firſt diſcoverers of the thoracic duct, deſcribed it as be-
ginning from a pyriform bag, to which they gave the
name of RECEPTACULUM CHYLI.   In dogs, fiſh, and
the turtle, ſuch a ciſtern or bag may be obſerved ; but
in the human body nothing further is to be obſerved
than an irregular dilatation of this veſſel, like a varicoſe
diſtention, where it receives the acceſſion of the lacteals
from the root of the meſentery.   The origin of this
great trunk, called the thoracic trunk, is the union of
the veſſels, which running by the ſide of the common
iliac veſſels, are derived from the pelvis and lower ex-
tremities.   Upon the third and fourth vertebræ, and
under the aorta, this trunk is frequently joined by a large
trunk of the lacteals, and then aſcending, it receives
the greater number, or the larger trunks of the lacteals.
On the vertebræ of the loins, the thoracic duct is by
no means regular, either in its courſe or ſize or ſhape ;
often it contracts, and again irregularly dilates, as it
ſeems to emerge from under the aorta.   On the upper-
moſt vertebra of the loins, the thoracic duct lies under
the right crûs of the·diaphragm, and then paſſing the
ſeptum with the aorta, it gets on the right anterior ſur-
face of the ſpine, and runs up betwixt the aorta and
the vena azygos ; it then paſſes under the arch of the
aorta, and there it is conſiderably enlarged, from the
contracted ſtate which it aſſumes in the thorax.   Some-
times it ſplits, and again unites on the vertebræ of the
back.   Having paſſed the arch of the aorta, it croſſes

* In the year 1651.
† In the year 1622.—About the year 1652, the other branches
of the ſyſtem, which take their courſe to every part of the body,
were diſcovered by Rudbeck, Jolyffe, and Thom. Bartholin.

to

to the left fide of the fpine, and we look for it under the pleura on the left fide of the œfophagus.

The thoracic duct now emerges from the thorax, and lies deep in the lower part of the neck, behind the lower thyroid artery, and on the longus colli mufcle.

It gets above the level of the fubclavian vein of the left fide, and here it receives the abforbents of the head and neck (of the left fide), and defcends again with a curve, and terminates in the angle of the union of the fubclavian vein and jugular vein of the left fide.

Sometimes there are two thoracic ducts; but this is very rare. Sometimes the duct fplits near its termination, and the two branches enter the veins feparately; but, in general, when it fplits in this manner, it again unites before it terminates in the vein.

There is conftantly a trunk in the anterior mediaftinum under the fternum, almoft as large as the thoracic duct itfelf, which is fometimes inferted into the termination of the thoracic duct; fometimes into the trunk of the abforbents of the left fide, to be immediately defcribed *.

THE TRUNK OF THE ABSORBENTS OF THE RIGHT SIDE.

The abforbents, from the right fide of the head and neck, and from the right arm, do not run acrofs the neck, to unite with the great trunk of the fyftem; they have an equal opportunity of dropping their contents into the angle betwixt the right fubclavian and the jugular vein. Thefe veffels then uniting, form a trunk which is little more than an inch, nay, fometimes not a quarter of an inch in length, but which has nearly as great a diameter as the proper trunk of the left fide.

This veffel lies upon the right fubclavian vein, and receives a very confiderable number of lymphatic veffels: not only does it receive the lymphatics, from the

* Cruikfhanks.

right

right fide of the head, thyroid gland, neck, &c. and the lymphatics of, the arm ; but it receives alfo thofe from the right fide of the thorax and diaphragm, from the lungs of this fide, and from the parts fupplied by the mammary artery. Both in this and in the great trunk there are many valves.

OF THE LACTEALS AND LYMPHATICS OF THE IN-TESTINAL CANAL.

We fhall afterwards have to obferve the great length of the inteftinal canal, the effect of the imperfect valvular ftructure, in extending the inner coat to a great length ; we have remarked that while every furface of the body fecretes, it is at the fame time an abforbing furface ; and finally, that while we chiefly contemplate the inteftinal canal, as imbibing and receiving the nourifhment, we muft not forget that it is alfo a fecreting furface of the firft importance to the œconomy. But at prefent we have merely to underftand that ftructure and organization, by which this canal abforbs the nutritious fluid the chyle from the food.

In the firft place, as to the terms lacteals and lymphatics, we prefume that the abforbents throughout the whole length of the canal have the fame ftructure and ufe ; and that the term lacteals has been fuggefted merely by the colour of the fluid, which is abforbed from the fmall inteftines. At one time thefe lacteals convey a milky fluid : at another. a tranfparent fluid, like that which the ftomach and great inteftines in general abforb.

The lacteals, as it is natural to fuppofe, were the firft difcovered of any part of the fyftem of abforbents ; or, at leaft, they were firft underftood to form a part of an abforbing fyftem. For although Euftachius, a Roman anatomift, difcovered the thoracic duct in the year 1563, yet he had very imperfect notions of its importance, and the difcovery was very little attended to, till after the difcovery of the lacteals by Afellius in 1622.

This

This anatomift, in opening living animals, to obferve the motion of the diaphragm, obferved white filaments on the mefentery, which he took at firft for nerves; but, on puncturing them, and obferving them to difcharge their contents and to collapfe, he proclaimed his difcovery of a new fet of veffels—a fourth kind *.

Had Afellius only chanced to obferve thefe veffels, his merit would have been inconfiderable; but he alfo inveftigated and announced their peculiar office, viz. of abforbing the chyle from the inteftinal canal, and carrying it into the blood.

For fome time, however, after the difcovery of the vafa lactea, the opinion of Hippocrates and Galen, viz. that the mefenteric veins abforbed the chyle from the inteftines, and conveyed it to the liver, ftill prevailed. Even after the difcovery of the lacteals was known and received, a part of the old fyftem was ftill retained, and it was fuppofed that thofe veffels carried the fluids abforbed from the inteftines into the liver; and that the fluids were there converted into blood.

About twenty years after the difcovery of Afellius, Rudbeck, a Swede, and Bartholin, a Danifh anatomift, faw Afellius's veffels in many other parts of the body; difcovered the trunk of the fyftem, and fhewed that the lacteals did not pafs to the liver, but that they were branches of a great and diftinct fyftem; they alfo demonftrated the unity of this fyftem.

We have feen from this fketch that the ancients fuppofed the veins of the inteftines to be abforbents; and even after the difcovery of the lacteals, this idea has been retained by fome of the beft modern anatomifts, and principally by Haller, and profeffor Mickel of Berlin. If the veins abforb from the furface of the inteftines, their doctrine would imply that they are alfo abforbents in general throughout the body. Although Bartholin, in his epiftle to Harvey, had afferted and given fufficient proof that the mefenteric veins were not

* The nerves being counted as veffels.

abforbents,

abforbents; yet the controverfy was left in fo unde-
cided a ftate, as to give occafion to the feries of ex-
periments in the fchool of the Hunters, which feems to
have put the queftion to reft, in as far as it is con-
nected with the lymphatic fyftem *:

We have already mentioned that Afellius was em-
ployed in opening the belly of a living dog, when he
firft difcovered the lacteals. He perceived upon the
furface of the inteftines and mefentery a great many
fmall threads, which, at firft fight, he took for nerves,
but foon difcovered his error; and to diffipate his
doubt, opened one of the largeft white cords, when no
fooner had the incifion been made, than he faw a fluid
like milk or cream iffue from the veffels. Afellius fays
he could not contain his joy at the fight of this pheno-
menon; and turning himfelf to Alexander Tadinus, and
the fenator Septalius, who were prefent, he invited
them to enjoy the fpectacle;—but his pleafure, he adds,
was of fhort duration, for the dog died, and the veffels
difappeared. The natural and fimple narration of
Afellius reprefents his aftonifhment, and gives an idea
of the fenfation, which the anatomift experiences in the
inftant of making an interefting difcovery †.

ORIGIN OF THE LACTEALS. When the young ana-
tomical ftudent ties the mefenteric veffels of an animal re-
cently killed, and finds the lacteals gradually fwell; when
he finds them turgid, if the animal has had a full meal,
and if he has allowed time for the chyle to defcend into
the fmall inteftines—and empty, or containing only a lim-
pid fluid if the animal has wanted food; he has fufficient
proof that thefe are the veffels deftined to abforb the nu-
tritious fluids from the inteftines. Again, when coloured
fluids are thrown into the inteftines of a living animal,
and they are abforbed, he has fufficient proof of their
free and ready communication with the inner furface
of the gut; but the actual demonftration of the ab-

* See the VEINS in this volume.
† Sheldon, Portal.

forbing

forbing mouths of the lacteal veffels is very difficult. The difficulty arifes from thefe veffels being in general empty in the dead body, from the impoffibility of inject-ing them from trunk to branch in confequence of their valves; and, laftly, from their orifices never being patent, except in a ftate of excitement. The anatomift muft therefore watch his opportunity when a man has been fuddenly cut off in health, and after a full meal. Then the villi of the inner coat may be feen turgid with chyle, and their ftructure may be examined. Perhaps the firft obfervations which were made upon this fubject by Lieberkuhn, are ftill the beft and the moft accurate.

The villi are apparently of a cellular ftructure, for although they are flat or conical, or like filaments when collapfed; yet when minutely injected, and efpecially when they are full of chyle, they take a globular form, and are called the AMPULULÆ. Their diftention, in confequence of a minute injection of the veins or arteries, is probably owing to a cellular ftructure (which they feem to have) into which the injection has extravafated. The moft probable account of the ftructure of thefe ampululæ is that this cellular ftructure is a provifion for their diften-tion and erection by the blood, when excited by the pre-fence of the chyle in the inteftines; that this erection gives rigidity to the orifice of the lacteals; and that the firft ftep of abforption is by capillary attraction, while the further propulfion of the fluid in the extreme abforbents is by the contraction of their coats excited by the prefence of the fluid. Thus the abforption is not by an inorgan-ized pore, but depending on excitement and action.

Lieberkuhn's obfervations of the villi are the moft ac-curate and curious. He obferves, that having opened and wafhed a portion of the fmall inteftine, its whole furface will be found covered with little pendulous conical membranes of the fifth part of a line in fize, and the bafes of which almoft touch each other. From the vaf-cular membrane, to which they are attached, he obferves there is given off to each villus a branch of a lacteal, an artery, a vein, and a nerve. He found it difficult by in-jection

4

jection to fhew both the vein and artery, the fluid paffed fo eafily from the one into the other. He found that the extreme branch of the lacteal was diftended into a little veffel within the villus. And on the apex of which, with the microfcope, he faw one or fometimes feveral openings; with his glaffes he obferved the arteries to ramify on the globules or ampululæ and again collect into veins; and he fuppofed that ftill more minute branches plunged into the centre. But he made a ftill more minute obfervation than this. Infulating a piece of inteftine betwixt two rings, only leaving a fpace for the entrance of the ramification of the artery which fupplied it, he injected with a column, and examined its progrefs at the fame time with his microfcope. As he raifed the tube, he faw the artery going in ferpentine turns to the villus, and the injection returning by the veins; at laft it paffed into the ampulia lactea, diftended it and made its exit by the foramina. He prepared the villi in another way:— he inflated the ampullæ, and kept them fo until they dried; then he cut them with a razor, and found them cellular. This cellular ftucture Cruickfhanks thinks is the common cellular fubftance, uniting the veffels of the villus. When this gentleman examined the villi of a patient who died fuddenly after a meal, he obferved fome of them to be turgid with chyle, fo that nothing of the ramifications of the arteries or veins were to be obferved; the whole appeared as one white veffel without any red lines, pores, or orifices; others of the villi contained chyle in a lefs proportion; and here the ramifications of the veins were numerous, and prevailed by their rednefs over the whitenefs of the villi.

In fome hundred villi he faw the trunk of a lacteal forming by radiated branches, one branch in each villus, Mr. Cruickfhanks and Dr. Hunter counted fifteen or twenty orifices in fome of the villi.

Mr. Cruickfhanks has remarked a deep and a fuperficial fet of lacteals on the inteftines; but for this divifion there feems no neceffity. Deep in the coats the lacteals feem to accompany the blood veffels; but when they get more

fuper-

uperficial, they take a courfe longitudinally on the canal, and turn devioufly, or after running a little way, take a fudden turn towards the mefentery.

As the greater frequency of the valvulæ conniventes in the jejunum, greatly increafe the extent of its inner furface of the gut, and confequently give a greater extent of origin to the lacteals; and, as here the chyle muft be in the greater quantity, fo the lacteals of this portion of the gut are larger and more numerous than in any other part of the extent of the canal.

The lacteals do not attach themfelves to the veffels of the mefentery, but take a more fuperficial courfe. Before they enter the mefenteric glands, they have been called lacteals of the firft order; when they emerge from the firft into the fecond glands, fecondary lacteals, or glands of the fecond order. The manner of their entering and going out of glands is exactly the fame with that of the lymphatics. The lacteals (or perhaps we fhould now fay the abforbents merely) of the great inteftines, are fmaller and lefs numerous than thofe of the fmall inteftines; for although the inteftines be large, ftill their inner furface is by no means fo extenfive: befides the chyle is abforbed, and the contents of the gut altered before they have defcended into the great inteftines. Both Winflow and Haller, however, affert, that they have feen chyle in the abforbents of the great inteftines. We know that the lacteals abforb chyle, when it is prefented to them: while at other times they abforb other fluids. That the abforbents of the great inteftines imbibe the fluid's contents is evident, from the change produced on the fæces in their paffage. Copious and nutritious injections have been given, which did not return in the fame liquid form, and which have fupported the ftrength for fome time. Clyfters of turpentine give the urine a fmell of violets; and the Peruvian bark has cured fever, when given by the rectum.

The abforbents of the ftomach form three divifions: one fet accompanies the coronary artery and vein, and enters the glands on the leffer curvature and omentum
minus.

minus. Thofe of the fecond fet accompany the left gaftro-epiploic artery, and are joined by the lymphatics of the omentum. The third pafs down upon the upper part of the duodenum following the arteria gaftrica dextra: thefe defcend to pafs into the fame clafs of glands, which receive the lymphatics of the liver. They are joined in their courfe by the lymphatics of the right fide of the omentum.

The lacteals on the mefentery pafs from one gland to another till they form one or two large trunks only. Thefe accompany the trunk of the fuperior mefenteric artery, and run down on the right fide of the aorta, and join the thoracic duct. The abforbents, from the rectum and colon of the left fide, pafs into their glands, or fometimes into the lumbar glands, and join the thoracic duct feparately; thofe from the right fide of the colon join or mingle with the lacteals in the root of the mefentery.

OF THE REMAINING ABSORBENTS OF THE SOLID VISCERA.

WHERE the lymphatics of the lower extremity defcend over the brim of the pelvis, they are joined by the abforbents of the bladder, veficulæ feminales, and other parts in the pelvis:—fmall glands belonging to this fet are attached to the internal iliac veffels. In the female, the lower fet of lymphatics, from the womb and vagina, alfo come by this route to join thofe of the lower extemity, or run mingling with them. Another fet of lymphatics of the womb pafs up with the fpermatic veffels.

The lymphatics of the TESTICLE are very numerous. They come in diftinct fets from the body of the tefticle, from the epidydimis, and from the tunica vaginalis: then reaching the cord, form fix or ten trunks, and run up direct to the abdominal ring; paffing the ring, they turn outward, and then pafs over the pfoas mufcle and into the lumbar glands.

The

The lymphatics of the KIDNEY are in two fets, fuperficial and deep-feated; but the former are feldom to be obferved. Sometimes difeafe makes them diftinct. The internal lymphatics are demonftrated by blowing into the veins, or tying a ligature and kneading the fubftance of the kidney with the fingers; when they rife, they are feen attached to the emulgent veffels, and go to join the lumbar glands, or terminate in large lymphatics near the aorta.

It is needlefs to repeat that the abforbents of the fpleen are deep and fuperficial,—for this arrangement is general. Emerging from the fpleen, the lymphatics pafs alongft the fplenic veffels, and enter into glands attached to the fplenic artery in its whole courfe. In this courfe they receive the abforbents from the pancreas, and near the head of the pancreas, they are blended with thofe of the liver, and with them join the thoracic duct.

The lymphatics of the liver are the moft eafily detected, and may be injected to greater minutenefs, than in any other part of the body. Although they have many valves, yet they do not feem to clofe the veffels intirely, nor interrupt the mercury from paffing from trunk to branch. The fuperficial lymphatics, which are fo numerous that we may fometimes fee the mercury in them covering completely a confiderable fpace, have free communication with the internal fet of veffels which are alfo numerous and large. The principal route of the lymphatics of the upper furface of the liver, is by the broad ligament: thefe perforating the diaphragm join the trunk, which we have noticed under the fternum, and in the anterior mediaftinum. It would appear however, that thefe lymphatics of the broad or fufpenfory ligament, are by no means conftant and uniform in their courfe: for fometimes they run down towards the lateral ligament, and perforate it there; fometimes they pafs down into the thoracic duct while ftill in the belly. Other lymphatics of great fize, run off from the convex furface of the liver upon the lateral ligaments, and pierce the diaphragm. The lymphatics on the lower or concave

furface

furface of the liver are more irregular than thofe of the convex fide. They unite with the deep lymphatics coming out of the porta alongft with the vena portæ, enter into the glands, which are feated on the trunk of that veffel, and join the thoracic duct near the root of the fuperior mefenteric artery.

The lymphatics of the LUNGS are nearly as numerous as thofe of the liver; but, indeed, in regard to this expreffion, it is more in relation to the facility of injecting and demonftrating the lymphatics, than to their comparative number. For example, if the lymphatics of the other vifcera could be injected to as great minutenefs as thofe of the liver, we fhould ceafe to confider that vifcus as more abundantly fupplied than other parts. The fuperficial lymphatics of the lungs form areolæ, and cover the furface almoft completely. They take a courfe to the root of the lungs, where they are joined by the deep-feated veffels, and together pafs into the bronchial glands, and here the lymphatics of both fides freely communicate.

The glands of the lungs are conftantly found both before and behind the bifurcation of the trachea : often thefe glands are of a very dark colour; nay, their fubftance is fometimes found refolved as it were into a fac of inky-like fluid. Upon the arch of the aorta, and the root of its great branches, are the CARDIAC GLANDS, which receive the lymphatics from the heart. The abforbents of the heart are fmall, but very numerous, and their larger branches attach themfelves to the coronary veffels. They then pafs to the cardiac glands, and mingling with thofe from the lungs, join the thoracic duct.

INTRODUCTORY VIEW

NERVOUS SYSTEM.

THERE can be no natural divifion of the nervous fyftem, for it is a whole fo connected in function, that no one part is capable of receiving or imparting any fenfation, or of performing the operation of the intellect.

The fyftem has, notwithftanding, been arbitrarily divided into the brain and nerves; the brain being fubdivided into the cerebrum, cerebellum, and medulla oblongata; while the nerves are fubdivided into the nerves of the fenfes, the vital and involuntary nerves, the nerves of voluntary motion.

The BRAIN is defined to be that foft mafs contained within the cranium, from which the nerves are propagated to the organs of the fenfes and over the body, beftowing fenfation, and acting as the agents of the will. It is believed to be the receptacle of fenfation and the inftrument of thought; but our ideas of its functions are vague and imperfect.

The fubftance of the brain is delicate and foft, having a flight degree of elafticity, but the nerves are firm and hard, and the elafticity they poffefs is in their membranes, while the matter of the nerve is fo difpofed, as to be undifturbed by their motion. It is their membranes which give them firmnefs and ftrength to enable them to pafs through the moving parts of the body without being bruifed, or having their function affected. The brain is

protected

protected and supported by the scull and dura mater; its peculiar matter is supported and nourished by the pia mater. The nerves contain the same matter with the brain; but in their course through the body this matter is disguised by the peculiar structure of their membranes, which, while they support this substance, nourish it also by conveying vessels to it, as the pia mater does to the brain. But the extremities of the nerves are again reduced to the same delicate texture with the brain.

In the structure of the brain and nerves there is an analogy with the other parts of the body. In a bone or a muscle there is the same intertexture of membranes supporting the peculiar substance which is the characteristic of the part, and conveying blood vessels for its nourishment. The muscular fibres, or the earth of bone, are, in the midst of this investing membrane, peculiar parts distinct in their properties, as the medullary substance of the nerves is amidst the cellular membrane, which divides it into fasciculi, and produces the fibrous appearance.

The nerves are cords extending to every sensible part of the body, and the sensibility results from the perfection of their function, and their continuity with the brain.

When it is said that the nerves are productions of the brain, we are not to understand that they are propagated from it to the distant parts of the body, as if drawn out from it like a thread from the flax. In the embryo the nerves are laid in their sheaths, extending to the remotest parts of the body. They are connected with the brain, and in this sense they may be considered as elongations of it, the perfect function of both depending upon their union.

When the trunk of the nerve of a limb is cut, it is only deprived of its connection with the brain, the centre of the nervous system; and little further effect is produced than the loss of sensation, and the destruction of the powers of the will over the limb: the nutrition and growth of the part continue, and the action of those parts, which are independent of the will, as the muscular power of the vessels of the limb, remains entire.

When

When a cut nerve re-unites, the power of motion is re-stored, but the senfation of the part is loft *   When a nerve has been cut acrofs, the irritation of the cut extremities produce acute fenfation, which is demonftration that the nerves are not tubes containing fluids : for then would this fluid efcape, and the nerve lofe its power ?— Modern phyfiologifts fpeak with affected moderation of the weaknefs of former opinions, and conclude that it is far more probable that the nervous fluid refembles the electric fluid, and that it is retained in the nerves like the electric matter in electric bodies, viz. by communication and infulation, that the nerves are the fole conductors, the other parts of the body cohibent fubftances.   A weak analogy as any which have been hitherto received as doctrines.   If there was a fluid in the brain and nerves like the electric fluid, then would the contact of cut nerves reftore fenfation, and indeed in that cafe fenfation might be communicated from one individual to another.   The properties of life are like to nothing inanimate, do not admit therefore of illuftration by things familiar, and analogy here always mifleads.   The weakeft and therefore the boldeft opinion lately offered, is that envelopes of the nerves were the moving powers to the mufcles, and that the medullary matter conveyed fenfation.   The opinion that the nerves poffefs a mufcular power, has little foundation.

The nerves of animals are in proportion to the fize of their bodies; but in many of the great tribes of animals the brain bears no fuch proportion.   The nerves of the organs alfo bear a relation to the neceffities of the animal, and the perfection of the external organ, not to the fize of the brain.   If the procuring of fuftenance depend upon the power of the organ of fmelling, or upon the ear, or the eye, or even the bill, an additional fupply of nerves is provided, or a peculiar apparatus of nerves, fuited to the want.

Looking to the ftructure and courfe of the nerves, we are led to conclude that they are analagous to the brain ;

* *Cuvier.*

that

that they confift of matter fimilar in ftructure and func-
tion to it, diffufed over the body, and included in the
pia mater, or in a fimilar delicate and vafcular mem-
brane, and that their proper fubftance confifts of mat-
ter like the brain, and nourifhed in the fame way. We
muft conclude alfo, that they are more independent of
the brain than the brain is of them ; for the nerves are
capable of continuing the operations of the animal body
independently of the brain ; but without the communi-
cation of fenfation through the nerves to the brain, its
function muft be totally unexercifed *.

The nerves, in their courfe through the body, form
ganglions, plexus, and net-works. By thefe a more
univerfal connection of the feveral branches of the
fyftem is maintained, fo that few if any nerves can be
traced to one point or origin. When the nerves form
ganglions, (which are like knots or fwellings upon
them,) their fibres are fplit and irregularly difperfed,
while there intervenes a peculiar fubftance refembling
the ftriæ of the cineritious fubftance in the brain †.

I do not know that any one in this country has of
late years attended more than I have done to the diftri-
bution and connection of the nerves. But after all I
am inclined to believe that the confent or fympathies
of parts proceeds from connections eftablifhed in the
brain, and that they do not refult from the interchange
of filaments in their courfe through the body ‡.

The nerves are not fent over the body like the arte-
ries. If arterial blood be fent to a part, it fignifies not
by what branch or circuitous rout that blood comes.

* Children have been born without the brain, and have lived fome
time. Act. Nat. Cur. Dec. 1. An. 8. p. 107. Hift. de l'Acad. R.
des Scienc. 1704. p. 29. and 1713. p. 27. Hall. Opufc. Anat. ix.
p. 281. De infant. fine cerebro editis vide Morgagni Adverf. ii.
xxxv.

† Monro. See alfo on this fubject Mickel Acad. Berolinen. and
Zinn. ibid. and An. Anat. Anton. Scarpa de Structura & Ufu Gan-
gliorum. Gottlieb Haafe de Gangliis Nervorum. Morgagni de
Structura Ufuque Gangliorum. Adverfar. Anatom.

‡ Scarpa comes to a different conclufion. See Annot. Anatomic.
p. 110.

On

On the contrary, in the nervous fyftem, the peculiarity of function or of fenfation refults from the particular nerve, and the connection of that nerve with the brain. However, it is more common to fay that in their extremities the nerves are peculiarly organized : that a nerve, in its courfe, is incapable of receiving any diftinct fenfation ; that when injured, it conveys to us the undefinable fenfation of pain ; and from the connection with the mufcles, and with the whole fyftem, it fhakes the limb with involuntary tremors, or fudden fpafms. And fo it is faid, that the fufceptibility of thofe peculiar impreffions which the organs of the fenfes convey, depends upon a ftructure diftinct from that of the brain, and diftinct alfo from that of the nervous cords ; and this organization is fo peculiar, that the nerves of one fenfe are quite incapable of receiving the impreffions which thofe of another are fitted to convey, though apparently to our reafoning thofe impreffions appear to be capable of producing a ftronger effect upon the nerves.

As the vital organs muſt be in perpetual action to ſupport life, nature has guarded thoſe functions by making them independent of the will, and leſs immediately dependent on the function of the brain. Nerves are ſent to the vital parts forming a diſtinct claſs from the nerves of ſenſation, or the nerves of voluntary motion. This is a proviſion which allows the exhauſted mental functions and the powers of the muſcles to be recruited by ſleep, while the operations of the animal œconomy neceſſary to life go on uninterrupted.

But yet it may be neceſſary to ſtate here, that although the brain has no ſuch power over the vital parts as it has over the voluntary muſcles, and although the vital parts poſſeſs little ſenſibility, yet there is a reciprocal influence betwixt the nerves and the vital organs. Violent paſſion, and eſpecially continued grief and intenſe ſtudy alters the ſtate of the ſecretions, and diſorders digeſtion ; while a loaded ſtomach blunts the faculties, and weakens ſenſibility, and if long continued, does not merely induce to ſleep, but permanently injures the mobility of the nervous ſyſtem. We muſt be ſenſible how often the exerciſe of the paſſions, and even the images which occupy the mind, produce phyſical changes on the body ; and again, a very principal part of pathology is to trace the conſequences of diſorder in the groſſer bodily functions in their effects upon the mind *.

As in ſleep the vital functions continue uninterrupted, ſo the diſeaſes of the brain, which reſemble ſleep, ſuddenly deprive the body of all voluntary exertion, while the vital motion remains for a time unimpaired, and ſinks gradually, for no part of the body is altogether independent of the healthy function of the brain.

It is neceſſary alſo that we ſhould recollect the connection of the higher attributes of a living being with the animal œconomy.

The brain, the nerves, and the nervous expanſions in the organs of the ſenſes, are dependent for the perpetual

* In Parturientibus Iræ Effectus. Vide Sandifort Theſaur. vol. iii. p. 331. 543: n. 589.

I renewal

renewal and fupport of their function upon the circula-
tion of the blood. We fhould be tempted to imagine,
that the nervous fyftem were a nobler part of the œco-
nomy not liable to change by the groffer operations of the
animal machine, did we not frequently fee the powers
of the mind as well as the functions of the nerves dif-
turbed, or altogether overthrown by the irregularities of
the bodily fyftem; were we not thus reminded of that
circle of connections and mutual dependencies which
fupport the whole. If the blood flows too rapidly upon
the brain, the intellect is difordered, the ideas come
in rapid and irregular fucceffion. If the exit of the
blood from the head be obftructed, there is an obftruc-
tion to the circulation of the blood in the extremities of
the veffels of the brain; the function of the brain is
fuddenly fuppreffed, becaufe, though its attributes feem
fo peculiar, it requires the perpetual circulation of the
blood through it to fupport its powers.

The effect of the circulation of the blood through the
nerves of the limb is not lefs remarkable. If the nerve
of a limb be cut or tied, the animal can no longer move
the limb, having loft the power of the will over it. But
if the great artery of a limb be tied, the function of the
nerve is, in a fhort time, equally deftroyed, becaufe the
circulation of the blood through the nerve being ob-
ftructed, it lofes its powers, and is no longer a living
part.

Thus, whilft the moving powers of the circulation of
the blood are dependent on the ftate of the nervous
fyftem, the nervous fyftem is as immediately dependent
on the healthy ftate of the blood, and the velocity of
the circulation.

The general conclufion to which we are naturally
brought is this. The vifcera of the abdomen fupply the
matter of the blood. The vifcera of the thorax perfects
the blood and fends it over the body to fuftain in the
body the principle of life; and this principle of life is
fenfibility, and is feated in the nerves, though power-
fully influenced by the circulation. Whilft the fenfibi-
lity of the body, each part to its peculiar ftimulus en-
ables

ables the whole to exift in activity : it is more important to obferve how the brain and nerves give us external relations; indeed, the whole operations of the animal œconomy are to fuftain, through the brain and nerves, a fentient intelligent being.

With this general view of our fubject, we proceed to inveftigate the anatomy of the brain as a diftinct part, without forgetting the unity of the fyftem.

A A. *Hemispheres of the cerebrum*
B. *Corpus Callosum* C. *Rapha*

CHAP. I.

OF THE MEMBRANES OF THE BRAIN, AND OF THE SUBSTANCE AND TEXTURE OF THE BRAIN ITSELF.

OF THE DURA MATER.

MANY authors, while they defcribe the cranium as containing the brain, conceive that it alfo gives its fhape. But the brain is formed before the bones which inveft it. The firft thing that we obferve in the embryo is the difproportionate fize of the brain to the diminutive body. The offification of the bones of the
                                                                    fcull
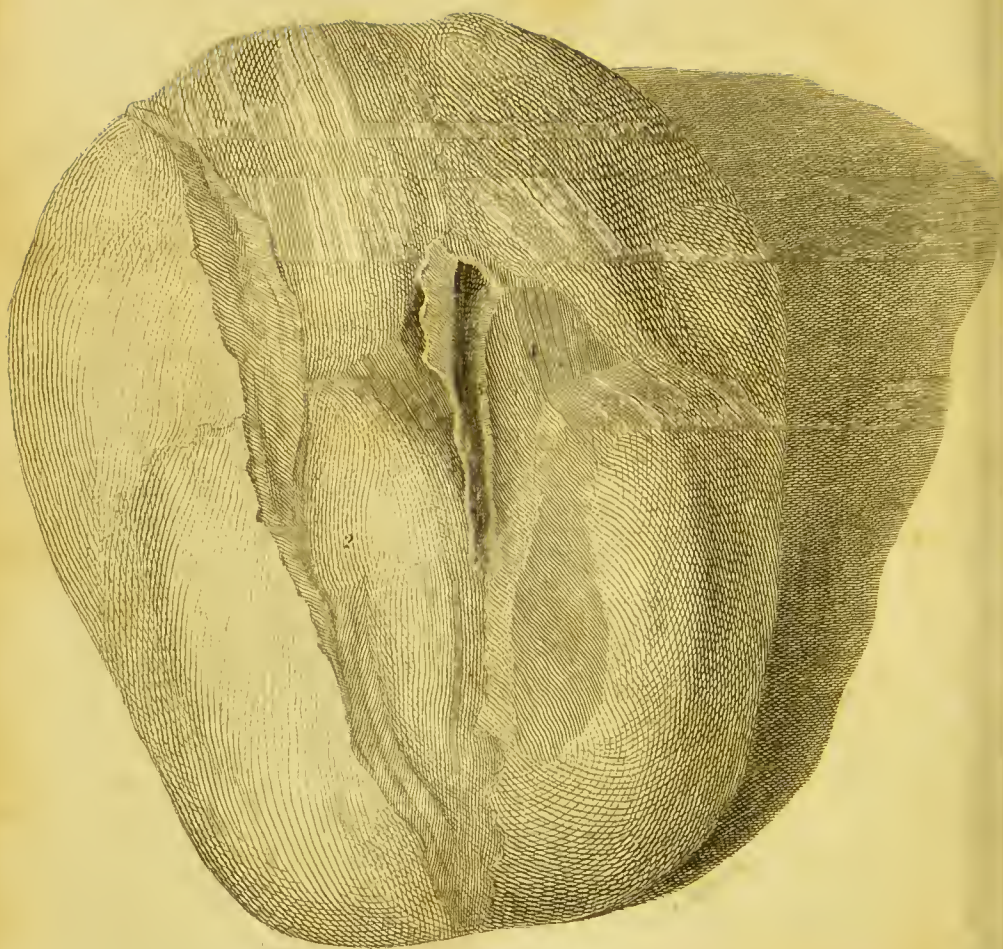
the Scull-cap of a Child before it be fully Ossified . 1 the Fontanelle . 2 the Pericranium extremely

Vascular . 3 the Longitudinal Sinus opened by cutting up the membrane in the direction of the

Sagittal Suture

ſcull is a gradual proceſs.   The brain, already formed, is inveſted with the ſtrong membranes ; and betwixt the laminæ of the outer membrane the points of oſſification commence, and are not completed until the ninth year. The bony matter, which is depoſited betwixt the layers of this membrane, retains a firm connection and interchange of veſſels with the now apparently diſtinct membranes on its inner and outer ſurfaces.   The outer layer, which is ſo ſtrong in children newly born, becomes the delicate pericranium, whilſt the inner layer is the dura mater.   Thus we find that the bones of the head are moulded to the brain, and the peculiar ſhapes of the bones of the head are determined by the original peculiarity in the ſhape of the brain.   .

This view corrects an error into which many have fallen, that the dura mater and the veſſels ramifying upon it impreſs their form upon the ſolid bones, and wear channels upon their ſurface by their inceſſant pulſation.   The membranes and veſſels precede the formation of the bone, and the oſſeous matter is depoſited ſo as to be moulded round the veſſels *.

Thus the dura mater may be conſidered as the internal pericranium †.

The dura mater ‡ is a firm and ſomewhat opaque membrane.—When the ſcull-cap is torn off, and it is cleaned from the blood which eſcapes from the ruptured veſſels, it is ſeen marbled with azure and roſy colours. It partakes more of the former in youth than in thoſe

* Albini Acad. Anat. " Quomodo cranium creſcendo accomodat ſe eis quæ continet."
  Fiſcher, Diſſertatio de modo, quo, oſſa ſe vicinis accomodant partibus.
  † Some regard only its external lamina as the internal pericranium. Haller t. iv. p. 92.   Fallopius firſt viewed the dura mater in this light, and he is followed by the beſt anatomiſts.
  ‡ The membranes of the brain have the name of *mater*, becauſe they defend the brain, and protect its tender ſubſtance ; or according to ſome anatomiſts of the Arabian ſchool, becauſe the other membranes of the body are produced from them.   Before Galen, the term Meninx was common to all the membranes of the body, afterwards it was appropriated to thoſe of the brain.

advanced

advanced in years, or in the robuſt and ſanguineous *.
Its outer ſurface is rough, from the adheſions to the
bone being torn up; but on the ſurface lying in con-
tact with the brain, it is ſmooth, ſhining, and of a pearl
colour.

Although the dura mater is really the ſtrongeſt mem-
brane of the body, it is yet diviſible into laminæ; theſe
are ſtrengthened and firmly connected by the intertex-
ture of ſtrong fibres. Moſt anatomiſts deſcribe it as
compoſed of two laminæ †. Some, however, deſcribe
three laminæ—the outer lamina, or ſquamoſa; the
middle, or filamentoſa; and the internal (being ſmooth
and uniform), the lamina membranoſa ‡. But to ſepa-
rate the dura mater into ſuch laminæ, it will, I believe,
be neceſſary to dry it and tear it into ſhreds. No doubt
it may be poſſible thus to tear it, as ſome have done,
into four, ſix, ſeven, or even eight laminæ or ſquamæ.
It is to be regretted that anatomiſts ſhould have been
proud of ſuch diſſections.

The dura mater is inſenſible; it has, in the way of
experiment, been pricked and injured by every poſſible
contrivance, by mechanical and by chemical ſtimulants;
yet the animals, the ſubjects of ſuch cruel experiments,
have given no ſign of pain §. Before this fact of the in-
ſenſibility of the dura mater was thus eſtabliſhed, phy-
ſicians regarded this membrane as the ſeat and origin of
many diſeaſes ‖.

* Malaearne Encefalotomia Nuova, p. 19.
† Soemmerring Corp. Hum. Fabrica, t. iv. p. 26. Haller, t. iv.
p. 91.
‡ Malacarne, p. 22. It is deſcribed as partly tendinous, partly
ligamentous: that is to ſay, of a nature reſembling theſe, yet not
altogether the ſame. Vicq d'Azyr found it ſeparated by purulent
matter into two laminæ, the fibres of which had a different direction.
Acad. de Sciences, An. 1781. p. 497.—Bartholin Sp. Hiſtor.
Anatomiæ.
§ Zinn. Exper. eirca corpus calloſum, cerebellum, duram menin-
gem.—Mem. par Haller ſur les parties ſenſibles et irritables.—Blegny
Journal de Med. An. 1. p. 16.
‖ See Hoffman. Med. Ration. part 2. ſee. ii. c. 1. § 2. and Boneti
Sepulch. Anat. lib. i. ſec. i.

Formerly

Formerly the natural connection of the fcull and dura mater was fo refolutely denied—fo hotly contefted among the various parties in anatomy and furgery, that we might, by reading their difputes, almoft doubt one of the plaineft and moft obvious facts, were not the clofenefs of this connection fufficiently proved by the manner of the original formation of the cranium, by the refiftance to the tearing up of the cranium, and by the bleeding furface of the dura mater ; or, if further proof be required, we may macerate thefe bones and their membranes in acids, when the laminæ of the dura mater will be feen intimately connected with the bone, while the pericranium and outer laminæ of the dura mater are feen to be continued into each other *, by the intermediate cellular texture in which the earth of the bones was lodged †.

The dura mater adheres more firmly to the bone in young fubjects, becaufe the bone is yet imperfect, and its furface fpongy and rough ; and, for the fame reafon, it is more firmly attached to the fcull in the chronic hydrocephalus, becaufe the offification is imperfect.

It frequently adheres fo firmly to the fcull-cap, as to leave its outer lamina adhering to the fcull when it is raifed. The dura mater is a fimple membrane as far as it is poffible, while every membrane is made up of cellular tiffue.

GLANDS OF THE DURA MATER.

Upon the external furface of the dura mater there are little holes, from which emerge flefhy-coloured papillæ, and which, upon examining the fcull-cap, will be found to have correfponding foveæ. Thefe are the

* Vicq d'Azyr Memoir. de l'Acad. Roy. 1781, p. 497, and Malacarne (Aderenze della D. M. alle pareti interne del cranio), p. 24.
† Taking a portion of the dura mater betwixt the finger and thumb, we can move the two lamina upon each other, owing to a flight degree of laxity in the connecting cellular fubftance. This cellular texture is demonftrated by Malacarne, by forcibly injecting quickfilver betwixt the layers of the membrane.

A A 3   glandulæ

glandulæ Pacchioni *. They are in number from ten to fifteen † on each fide, and are feen chiefly lateral to the courfe of the longitudinal finus. Thefe bodies were fuppofed by Pacchioni to be glands. When preffed they give out a fluid ‡ ; but in this they do not differ from the loofe common cellular membrane. As they are chiefly feen along the line of the great finus, and are not fcattered over the whole dura mater, their fuppofed ufe of moiftening the furface of the membrane § is quite improbable ; and, indeed, this is a part of that unfounded hypothefis which fuppofed an interftice betwixt the dura mater and fcull, and afcribed motion to this membrane. The furfaces of the dura and pia mater, where they are in contact, being of the nature of the fecreting furfaces of the invefting membranes of the other vifcera, require no fuch further aid in moiftening them, or preventing their adhefion. Many glands are defcribed by authors in the fubftance, and upon both furfaces of the membrane. Of the bodies which adhere to the furface of the pia mater, and of thofe alfo which are to be feen in the finufes, we fhall fpeak afterwards, when confidering the veins which enter the longitudinal finus.

ARTERIES OF THE DURA MATER.

THIS membrane muft neceffarily be fupplied with veffels for its own nourifhment, for that of the contiguous bone, and for the perpetual exudation of the fluid, or halitus rather, which moiftens or bedews its internal furface. We may divide the arteries of the dura mater into anterior, middle, and pofterior. The firft proceeding from the ophthalmic and ethmoidal branches of the internal carotid; the fecond from the

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* See M. Littre Acad. Roy. des Sciences, 1704. Hift. p. 32. art. 19.

† Haller, El. Phyf. p. 106. Mem. par M. Vicq d'Azyr. Mem. de l'Acad. Roy. 1781, p. 497.

‡ Malacarne.

§ Viz. the opinion of Fantonius.

internal

internal maxillary and fuperior pharyngeal; the pof-
terior from the occipital and vertebral arteries and pof-
terior auris *.

The principal artery of the dura mater, named, by
way of diftinction, the great artery of the dura mater,
is derived from the internal maxillary artery, a branch
of the external carotid. It is called the fpinalis, or
fpheno-fpinalis, from its paffing into the head through
the fpinous hole of the fphenoid bone; or meningea
media, from its relative fituation, as it rifes in the great
middle foffa of the fcull. This artery, though it fome-
times enters the fcull in two branches †, ufually enters
in one confiderable branch, and divides foon after it
reaches the dura mater into three or four branches, of
which the anterior is the largeft; and thefe fpread their
ramifications beautifully upon the dura mater, over all
that part which is oppofite to the anterior, middle, and
pofterior lobes of the brain. Its larger trunks run upon
the internal furface of the parietal bone, and are fome-
times for a confiderable fpace buried in its fubftance.
The extreme branches of this artery extend fo as to
inofculate with the anterior and pofterior arteries of the
dura mater, and through the bones (chiefly the parietal
and temporal bones) they inofculate with the temporal
and occipital arteries ‡.

The meningeal artery has been known to become
aneurifmal and diftended at intervals, it has formed an
aneurifm, deftroying the bones, and caufing epilepfy §.

OF

* Soemmerring, C. H. Fabric. A. Murray, Defcrip. Arteriarum,
in tab. redact.

† Soemmerring de Corp. Hum. Fab. tom. v. p. 142. This is not
the fole artery fent to the dura mater from the internal maxillary, a
twig alfo rifes from that branch which goes to the pteregoid mufcles
and parts about the Euftachian tube—it enters the fcull, and is dif-
tributed to the fifth pair of nerves, and to the dura mater and caver-
nous finus. Another enters with the inferior maxillary nerve by the
foramen ovale, and rifes upon the dura mater.

‡ Malacarne.—Soemmerring, tom. v. p. 142.

§ Malacarne, p. 1. fec. 105. " Poffono le arterie, della D. M.
" devenire aneurifmatiche, il che ho veduto in due cranii, in uno dei
" quali l'arteria fpinofa era tutta gozzi tanto a deftra quanto a finiftra,
A A 4   " i mag-

The Scull Cap with the D.M. adhering.
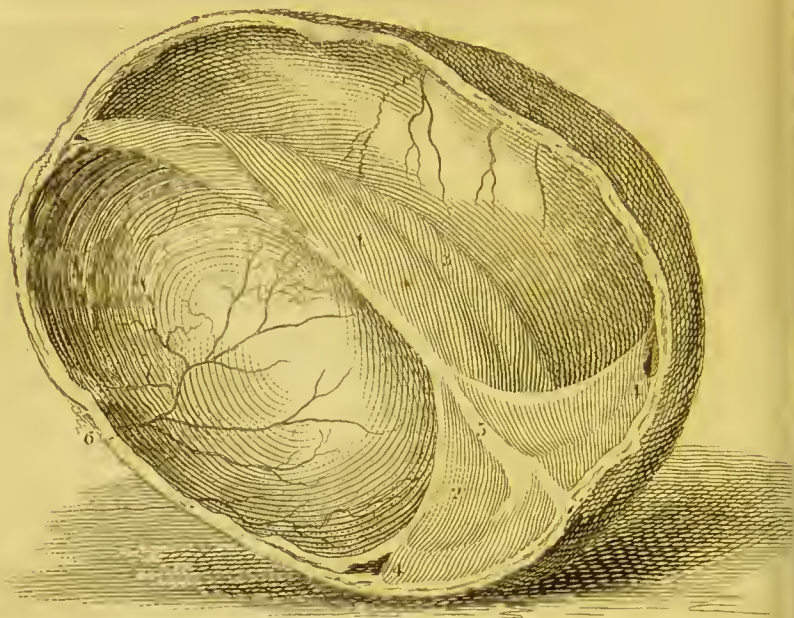
1. Fale. 2. Tentorium. 3. Longitudinal Sinus
4.4. great Lateral Sinuses. 5. Fourth Sinus
6. artery of the D.M.

OF THE SEPTA WHICH INTERSECT THE BRAIN.

THOSE septa, or, as they are called, proceſſes of the dura mater, being extended acroſs from the internal ſurface of the cranium, ſupport the brain in the ſudden motions

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" i maggiori dei quali (ed erano cinque dal primo, e nove dall' altero
" lato) poco ſuperavano la groſſezza dei piſelli : nell' altero ancor gio-
" venile ſi vedevano due ſoli gozzi uguali in diametro al mignolo ſul
" tronco mezzano dell' arteria ſpinoſa rempetto alla meta del parietale
" ſiniſtro, diſtanti nove linee circa l'inferior anteriore dall' altro."
Part i. § 105. We have alſo the following caſe from Malacarne.
" Juvenis, ætatis 22 annorum, ſanguinei temperamenti, poſt vehe-
" mentiſſimos, et frequentes epilepſiæ motus in noſocomio D. Joan
" ni

motions of the body, and prevent the mutual gravitation of its parts ; but I believe they are chiefly ufeful in retaining the finufes in their triangular form.

Thefe partitions are formed by the reflection of the internal lamina of the dura mater.

The falx is the largeft of the partitions ; it is attached to the cranium in the line of the fagittal future, and reaching from the crifta galli of the ethmoid bone to the middle of the tentorium, or to the crucial ridge of the occipital bone, it paffes deep into the middle of the brain, and divides it into its two hemifpheres. It is in fhape like a fcythe, for anteriorly it does not pafs fo deep into the fubftance of the brain ; but it gradually becomes broader, or defcends deeper betwixt the hemifpheres, as we follow it backwards, which, with the curve, it neceffarily takes from the fhape of the cranium, has obtained it the name of falx : it is alfo called feptum fagittale, verticale, or mediaftinum cerebri *.

_____

" nis, tumente in fumma bregmatis offium parte capitis cute, fub
" meis oculis moriebatur. D. Caccia in hac noftra univerfitate tunc
" Botanices profeffor, quem mihi patronum a morte peremtum adhuc
" defleo, ut cadaver aperiretur jufferat, atque in ejufdem capite ex ea
" parte, qua tenuiffima devenerant offa, ob arteriarum fubrepentium
" inter duræ matris laminas aneurifmata, os quoque omnino deficiens
" reperiebatur, fub capitis integumentis aneurifmata magnitudinis
" ovi columbini, exiguo, perruptoque foramine aperto, ut fanguis fub
" integumentis concrevifcet ; atque tunc novimus ad ea aneurif-
" matum loca, quæ quidem utrinque erant, in vehementia morbi
" ægrum pugnos infligere confueviffe."—We have feen blood under
the bone from this artery : and a deftruction of the bone by what is
called fungus of the dura mater, and this middle artery opened by
an arrow which ftuck in the parietal bone, but there is much difficulty in underftanding how fo fmall an artery in the circumftance of
meningea media can form a proper aneurifm. In the cafe of this artery opened by the arrow, the furgeon was cautious of applying
preffure, left the blood fhould force its way betwixt the dura mater
and bone, or diffufe itfelf upon the furface of the brain ; he bled the
boy largely in the arm, but it had no effect upon the hæmorrhagy ;
and fearing to bring on a greater degree of inflammation by applying
the trepan, he made a flight compreffion, and in the now languid
ftate of the circulation, the bleeding was fuppreffed.

* The falx has not been found in fome fubjects. Garengeot
Splanchnologie.—Mr. Carlifle, Medical Tranfactions, 1793.

The

The TENTORIUM feparates the cerebrum and cere-
bellum.   It ftretches horizontally over the cerebellum,
and fuftains the pofterior lobes of the cerebrum.   It is
formed by the inner lamina of the dura mater, reflected
off from the os occipitis along the whole length of the
grooves of the lateral finufes, and the edge or angle of
the temporal bones.   This feptum, thus running round
the cavity of the cranium, divides it into two depart-
ments; the upper one for the lodgment of the cere-
brum, and the lower for the cerebellum.   But to allow
the union of thefe two great divifions of the encephalon,
a circular opening is left upon the anterior part of the
tentorium, which is called the notch of the tentorium.

There is a little procefs of the dura mater which may
be called the FALX of the CEREBELLUM.   It runs down
upon the internal fpine of the occipital bone from the
tentorium, gradually contracting until it terminates on
the margin of the great occipital foramen.   It ferves as
a kind of ligament ftrengthening the tentorium, while
it divides the cerebellum.   It enters, however, but a
little way betwixt the lobes.

The falx and tentorium being connected and conti-
nued into each other at their broadeft part, they mu-
tually fupport each other, and are quite tenfe.   This
tenfenefs depends on their mutual fupport, for when one
of them is cut, the other falls loofe *.

The lateral extremities of the tentorium are continued
forward into acute lines, formed by the duplicature of
the dura mater coming off from the edges of the pars
petrofa of the temporal bones, and take firm hold on
the pofterior clynoid procefles.   From thefe two points
a fold of the membrane ftretches forward on each fide
to the anterior clynoid procefs, forming thus a hollow
or cell for the lodgment of the pituitary gland.   Another
fold or duplicature of the dura mater runs onwards a
little way from the edge of the little wing of Ingratius.
Thefe are the SPHENOIDAL FOLDS.

Where the internal lamina of the dura mater forfakes

* Monro.

the

the external to form the falx and tentorium, it leaves a
channel or triangular canal; the bafis of which triangle
is the lamina of the membrane invefting the cranium,
while the tenfion of the partitions carries the apex out
into an acute point. This forms a channel for receiving
all the blood of the veins, and this tenfion and triangu-
lar fhape gives a degree of incompreffibility to the canals.
Thefe are the finufes which receive the veins of the en-
cephalon, and guard them from compreffion :—

Section of the Longitudinal Sinus.

the Scull

the Dura Mater

the Extremeties of the Artery

the D.M.paffing into the bone

3. the Falx

4. the Sinus

6. A branch of the Temporal Artery
paffing into the D.M.
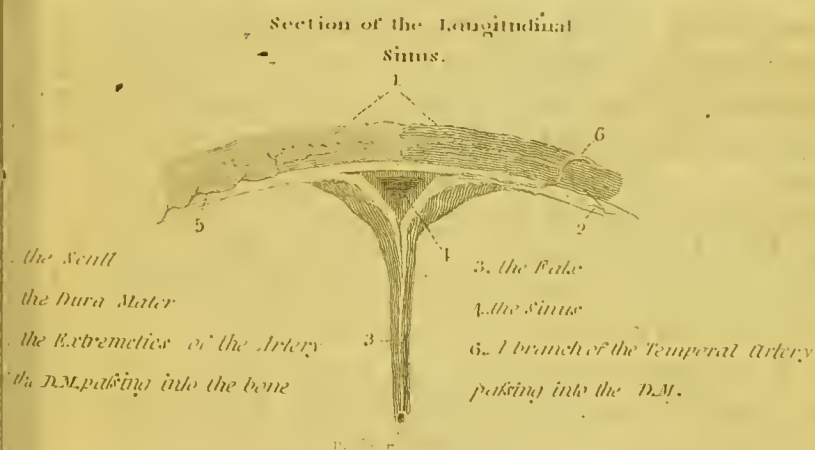
Upon the furfaces of the dura mater there are many
lacerti, or flips of fibres, which are interwoven with the
main body of the membrane, and ftrengthen it. Thefe
fibres are peculiarly ftrong in the angles, where the du-
plicatures pafs inwards, giving firmnefs to the finufes,
while they allow the veins to infinuate their trunks be-
twixt them; thefe fafciculi, or flips of fibres, on the fides
of the finufes, are the cordæ Willifianæ. They were con-
fidered by Baglivi and Pacchioni * as the tendons of the
mufcles of the dura mater, Pacchioni conceiving that this
membrane was mufcular. Vicq d'Azyr obferves, that in
inflammation of the dura mater he has feen it red, and
of a flefhy appearance; and that fuch a circumftance

* Thefe were Italian anatomifts. Pacchioni was phyfician to
Clement the XI.

might

might have deceived Pacchioni, and made him believe that there were mufcular bellies *.

Thefe phyficians conceived that the contraction of the falx and dura mater raifed the tentorium; they even conceived that the action of the heart depended upon this motion of the dura mater †. They were deceived by the pulfation in the arteries of the brain, communicated to the dura mater, after the operation of trepan, or in their experiments on living animals ‡.

The motion communicated to the dura mater thofe Italian anatomifts conceived to depend on the rifing of the tentorium. This motion, which is occafioned by the beating of the arteries of the brain, had been long before obferved § : fome conceived it to be a motion in the brain itfelf, others believed it to depend on the finufes ‖.

The motion caufed by refpiration was likewife obferved ¶. M. de Lamure's conclufion was, that the motion of the brain was caufed by the reflux of the blood towards it from the vena cava in expiration **. He undertook to demonftrate this; and he conceived his proof to be good, when, by preffing the ribs of a fubject, he

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* Mem. de l'Acad. Roy. 1781.

† Duverney.

‡ There is a diftinction in the movement of the dura mater to be obferved upon opening the fcull; one depending upon the pulfation of the arteries of the brain; the other caufed by an obftruction to the exit of blood from the cranium, depending upon the lungs. " On voyoit bien la pulfation des arteres du cerveau, qui " communiquoient quelque mouvement à la dure mere, mais ce mouve- " ment n'avoit aucune fymmetrie avec celui de la refpiration. " Fatigué de ne rien voir après avoir fi bien vû je comprimai la poi- " trine de l'animal : auffitot le cerveau fi gonfla, evidemment par le " reflux du fang de la poitrine qui rempliffoit la jugulaire.—Je lachai " la poitrine, et le cerveau redefcendit."—Exper. 78. Mem. ii. par Haller fur le Mov. du Cerv.—" Il arrivoit pourtant de tems en tems et " fans que cela continuat que le cerveau fe foulevoit dans l'expira- " tion, et fe laiffoit repomper dans l'infpiration." Exper. 79. f. chat.

§ By Coiterus, Riolanus, Bartholin.

‖ Diemerbroeck.

¶ M. Schlichting Mem. des Savans Etrangers, 1744. Lorry, Mem. prefent. a l'Acad. des Scien. par divers Savans Etrangers.

** M. de Lamure ; vide l'Acad. de Sciences, 1744.

faw

faw the refluent blood fwelling the jugular and abdominal cava. Haller obferved the jugular veins fwell, and become turgid, during expiration ; and he concluded, that the motion of the brain was occafioned by the refluent blood diftending the finufes of the brain. But he did not believe, as Lamure did, that this motion took place before the opening of the cranium, as well as after it.

When the fcull is opened by a wound, the dura mater ftill protects the brain, refifting inflammation, and giving the neceffary and uniform fupport to the more delicate fubftance and vafcular membrane of the brain ; but when the dura mater is lacerated by the trepan, or punctured, or worn by the pulfation againft the edge of the bone, there may be fudden hærnia of part of the brain from coughing, or a rapid and difeafed growth from the pia mater forming a fungus. Such fungus I once thought was, in fome degree peculiar to children, but it is not ; it is occafioned, I conceive, by the taking away of that due compreffion which the refiftance of the dura mater ought to give *.

OF THE TUNICA ARACHNOIDEA.

WHILE the dura mater is clofely connected with the cranium, and in contact with the furface of the brain, but ftill unconnected with it, (except by means of veins entering the finufes and that only in the courfe of the finufes) the pia mater is clofely attached to the brain, and paffes into its inmoft receffes. While the dura mater is firm and opaque, and not prone to inflammation, the pia mater is delicate, tranfparent, extremely vafcular, and peculiar in being eafily inflamed †. Like the dura mater, it is not endowed with fenfibility ‡ ; it is of great ftrength, confidering its apparent delicacy §.

* I have feen in one day feven wounds of the head with fracture ; of thefe, three had the bones thruft through the dura mater. Thefe three died with fungus cerebri ; the others did well.
† Mr. Hunter on the blood.
‡ Haller, Oper. Minor. de Part. Corpor. Humani fent. & irrit.
§ Sir C. Wintringham Exper. Effays. Taken comparatively, it is ftronger than the aorta.

The

The pia mater, which was formerly confidered as a fimple membrane, confifts, in reality, of two membranes, the tunica arachnoides, or meninx media, and the proper pia mater, or tunica vafculofa *.

The TUNICA ARACHNOIDEA was difcovered and commented upon by a fociety formed by Blafius, Sladus, Quina and Swamerdam †. They called it Arachnoides, becaufe of its extreme tenuity, comparing it to a fpider's web. It was called alfo Membrana Cellulofa, from the appearance it took when they infinuated a blow-pipe under it, and blew it up, feparating it from the pia mater ‡.

This membrane is without the pia mater; and while the pia mater finks down into the fulci of the brain, this covers the furface uniformly, without paffing into the interftices of the convolutions, or into the ventricles §.

This membrane is fo extremely thin, that it cannot by diffection be feparated for any confiderable fpace from the pia mater, and leaft of all, over the middle hemifphere of the brain. By the blow-pipe, indeed, we may raife it into cells, but it immediately fubfides again; on the pofterior part of the cerebellum, on the fpinal marrow and bafe of the brain, it is very eafily raifed and demonftrated ‖. It does not pafs deep into the fulci of the brain, but unites them by an extremely delicate cellular texture.

* There are many, however, who with Lieutaud confider the arachnoid coat as the external lamella of the pia mater.

† This was in 1665. I am, perhaps, not correct in faying they difcovered it; for Varolius defcribes it plainly, covering the medulla oblongata.

‡ Ruyfch. Tab. 10. Epift. Anat. Prob. viii.

§ Haller Elemen. Phyf. tom. iv. fec. viii. p. 7.

‖ F. Ruyfchii Refponfio ad A. os Goelecke Epiftol. ix. See Bidloo, table 10; but the membrane is fo delicate that it can be but very imperfectly reprefented by engraving. See alfo Sandifort. Thefaur, vol. ii. p. 291.

OF THE PROPER PIA MATER, OR TUNICA VASCU-
LOSA.

THE pia mater is a fimple membrane, without either
tendinous, aponeurotic or mufcular fibres. It is extremely
vafcular, but it is tranfparent in the interftices of its
veffels; it is the membrane which immediately invefts
and connects itfelf with the fubftance of the brain; and
although delicate, it forms the fupport and ftrength of
the cineritious and medullary fubftance. All veffels dif-
tributed in the body, however minute, are always con-
veyed in membranes; the pia mater then follows, or
rather conveys the veffels not only into the cavities of the
brain, but to every part of its fubftance, it being inti-
mately blended with it *. We fee it more diftinctly de-
fcending in ftrong plicæ into the interftices of the convo-
lutions; nor is it into them only that it enters, but into
every pore which conveys a veffel †. The pia mater as
it paffes into the fubftance of the brain, divides and fub-
divides into partitions and cells, and every capillary vef-
fel, and every molicule of the fubftance of the brain is
invefted and fupported by its fubdivifions. The pia mater
is to the brain what the cellular membrane is to the
other vifcera and parts of the body; for it is the peculiar
matter lying in the interftitious cellular membrane (as
in mufcles, bones, &c.) that gives the peculiarity of
character to the parts ‡; the cellular membrane itfelf is
nearly

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* Columbus, the affiftant of Vefalius, and afterwards profeffor
in Rome, explained this intimate intertexture of the pia mater with
the proper fubftance of the brain, fo far back as 1559.

† When we tear off the pia mater from the brain (for it cannot
be called diffection), it does not adhere merely at the fulci, but
to the whole furface of the convolutions; and every where fmall
veffels enter, and with thefe veffels defcends alfo the lamina of the
pia mater.

‡ " Sed cum continuo triduo in inquifitione facienda perfeveraf-
" fem : tandem deprehendi cerebri fibrillas eadem ratione, continu-
" ataque ferie, fibi invicem annexas effe; quemadmodum fibrillas
" carneas tendinibus adhærere demonftravi; cum igitur illam cerebri
" cum vafis fanguineis connexionem deprehendiffem; et eam, quam
" ante

nearly alike in all ; therefore, in my judgment, the pia
mater is rightly confidered by fome anatomifts as a cel-
lular fubftance *.

Malacarne fays, I am much inclined to confider it
with the illuftrious Haller as being compofed of lamina,
like common adipofe membrane, and that the extreme
arteries ramify through its cells, for, with a blow-pipe,
we can raife it into cells like the common membrane ;
and if this be carefully done, the air may be made to
pafs from cell to cell, following the arteries in their courfe
betwixt the lobuli, and in the fubftance of the brain †.
We can follow the mater into the ventricles, by tracing
it betwixt the pofterior lobe of the cerebrum and the
cerebellum, where it forms the velum interpofitum of
Haller, and paffes under the fornix. We can follow it
alfo into the pofterior horn of the lateral ventricles from
the bafe of the brain, where the branches of the middle
artery of the cerebrum pafs into the lower part of the
choroid plexus ; we trace it alfo into the bottom of the
fourth ventricle. The pia mater lining the ventricles is
more delicate, and lefs vafcular than that feen upon the
furface, and betwixt the convolutions of the brain.

It has been faid that the ventricles of the encephalon
ferved to increafe the furface of the pia mater, and that
whatever purpofes are ferved by that membrane and its
veffels on the furface of the brain, we muft fuppofe the
fame performed by it within the ventricles ‡. This feems
more like a fatisfactory conclufion than it really is.

" ante dixi, variorum fructuum compagem attenderem ; iterum con-
" clufi dominum, univerfi conditorem, in rerum creatarum fabrica
" eafdem vel confimiles fere leges tenuiffe."—" Igitur adverti fibril-
" las certo loco fibi conjunctas, mox alio loco ab invicem divertere,
" paulo poft iterum coëuntes." &c.   Leeuwenhoek Epift.   Phyf.
xxxiv.
    * Bergen. Program. de pia matre.   See Haller Anat.
    † See Albinus Ann. Acad. Vol. i. lib. i. cap. xii. and the beauti-
ful plate iii.   See Ruyfch. tab. 8. Epift. Anat. vii. & tab. 15. Such
is the profufion of veffels diftributed to inconceivable minutenefs, that
it has been confidered as entirely compofed of veffels; it has received
the name of chorion, from the membrane of the fecundines.   Galen
de Ufu Part. l. viii. cap. 8.   Malacarne, Part i. fec. 243.
    ‡ Dr. Monro's Nervous Syftem, chap. vi.

4   As

As the tunica arachnoidea is of a peculiar nature, and has few if any veffels, and as it covers the external fur-face of the brain only, it feems to me probable that this membrane is the caufe why effufions in the ventricles are fo common, and why fluids are fo feldom found betwixt the furface of the brain and the dura mater. When by the difeafed action of the veffels of the pia mater on the furface of the brain an effufion is thrown out, it very feldom lies unconfined upon the furface; but frequently fluids are contained in facs of the arachnoid coat, be-twixt the convolutions of the brain, or raife pellu-cid veficles upon the furface. The want of a tunica arachnoidea upon the pia mater of the ventricles, may be a caufe of the fluids being fo much more readily fe-creted into thefe cavities.

The raifing of the archnoidea into veficles by the ac-tion of the veffels of the pia mater, is rather an argu-ment for the diftinct nature of thefe membranes. The tunica arachnoidea is raifed by the action of the veffels of the pia mater, as the cuticle is raifed into blifters by the inflammatory action of the veffels of the cutis, while no other membranes of the body prefent fuch an appear-ance in their difeafe. They inflame, indeed; they thicken; their lamina become more diftinct, or their cellular fubftance fills with water, or hydatids are formed in them; but this appearance of water fecreted under the tunica arachnoidea is quite peculiar.

Section of the right Hemisphere
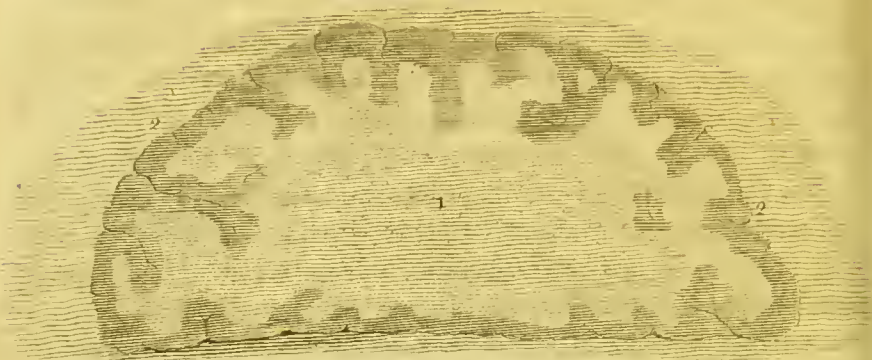
1 Central Medullary Matter 2 Cineritious or Cortical Matter.

OF THE SUBSTANCE OF THE BRAIN.

THE cerebrum and cerebellum confist diftinctly of two very different fubftances; the cineritious and medullary matter, firft defcribed by Arch : Pico-lomini. The cineritious, or afh-coloured matter, forms the fuperficial or outer part of the encepha-lon, and is therefore called alfo the cortical part. This cortical matter is of a reddifh-grey colour and femitranfparent, but varies confiderably *; in the crura cerebri it is very dark; in the pons varolii it is redder; in the corpora olivaria † it is yellower. The confif-tency of this matter alfo varies confiderably in different parts;

* Cuvier defcribes it black in fome places.
† Vicq d'Azyr.—" Exterior cerebri totius facies, donec in fpina-
" lem medullam abeat, plerumque colore eft fubrubride cinereo, vel
" languide ruffeo. Fufciora funt cerebra fanguine ditia, e. g. homi-
" num apoplexia enectorum, vel hominum craffioris fanguinis; palli-
" diffima vero funt cerebra hydropica vel hominum pituitoforum vel
" hæmorrhagia mortuorum. Dubio procul color cerebri fanguini:
" temperaturam feiqutur, et ideo pallidius eft infantibus, quam adul
" tis." Sommerring Hum. Corp. Fab. vol. iv. p. 41. As Boerhave
never

parts; it is soft in the base of the brain, betwixt the optic nerves and anterior commissure, and in the third ventricle. The medullary matter is chiefly in the internal part of the brain, forming a kind of nucleus or white central part; but in many parts of the brain, there is a mixture of these which form striæ *; and in some of the eminences, the internal part is cineritious, while the external part, or what we might here call the cortical part, is medullary.

The cortical or cineritious substance does not blend gradually with the white medullary matter, but on the contrary, their line of distinction is abrupt: an intervening substance has been observed. In inflammation of the brain, particularly, it has been said, that this third substance has been found. This may be merely the effect of light upon the union of the two substances. We, however, often observe an appearance of successive coloured circles upon the edge of the medullary matter of the arbor vitæ, in the cerebellum.

It has been asserted by M. Ludwig ‡, that the masses and striæ of the cineritious substance, dispersed through the internal parts of the brain, have a communication with each other. This, however, is denied by Vicq d'Azyr §. He conceives, that the cineritious substances of the pons varolii, or of the corpora olivaria, have no communication with the cineritious substance in any other part of the brain; and that in several parts of the brain the cineritious substance is surrounded and isolated by the medullary matter. Its great importance (which

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never saw, or observed, but merely imagined, he ought not to be regarded; now we may look for a better purpose into Albinus. Annot. Academ. vol. li. c. xii.

* Thus the cineritious substance is mixed with the medullary matter in the corpus callosum, in the corpora striata, the thalami nervorum opticorum, in the tubercula quadrigemina, the immenentia mamillaria; in the crura cerebri; in the pons varolii; in the corpora olivaria, and medulla spinalis.

† De Cinerea Cerebri Substantia. Lepsiæ.

‡ Hist. de l'Acad. Roy. an 1781. p. 507.

should

ſhould never have been doubted) has been deduced from its being ſo generally found towards the origin of the nerves *.

The cineritious ſubſtance ſeems to have a much greater quantity of blood circulating in it than the medullary ſubſtance. Its veſſels come by two diſtinct routs, partly from the extremities of thoſe arteries which appear in large branches upon the ſurface of the brain, and partly by veſſels which penetrate through the medullary ſubſtance from the baſe of the brain. Ruyſch and Albinus have made the moſt minute injections of this part of the brain. The former conceived it to conſiſt entirely of veſſels ; but Vicq d'Azyr and Albinus found always, in their experiments, that a great proportion of it remained colourleſs after the moſt minute injection. It is, indeed, very improbable, that ſo ſoft a body ſhould be enterely compoſed of veſſels. How, for example, can we ſuppoſe the commiſſura mollis, or cineritious matter, on the ſides and bottom of the third ventricle, or the almoſt tranſparent lamina, which we find in ſome parts, to be compoſed of veſſels †?

The white MEDULLARY SUBSTANCE appears to be a pulpy maſs. We obſerve no peculiarity of ſtructure in it towards the ſurface of the brain, where it is contiguous to the cortical matter ; but towards the origin of the nerves it takes a more fibrous appearance. This appearance of fibres is not owing to any peculiarity in the me-

* Il faut que les uſages de la ſubſtance griſe ſoient tres-importans ; car independamment de la portion de cette ſubſtance que les circonvolutions contiennent, et qui ſemble appartenir à la maſſe blanche du cerveau, ou en obſerve des amas plus ou moins conſiderables pres des diverſes origines des nerfs : ainſi pres de la premiere et la deuxieme paire, ſont les corps ſtries et les couches optiques ; la troiſieme paire eſt pres d'un eſpece noiratre que je decrirai ailleurs ; la quatrieme paire fort au deſſous des tubercules quadrijumcanx, dont le noyau eſt compoſè de ſubſtance griſe, la cinquieme, la ſixieme, la ſeptieme, ſe trouvent aux environs de la protuberance annulaire, ou la ſubſtance griſe eſt mêlée avec la blanche ; la huitieme et la neuvieme ſont placées pres de l'eminence olivarie, où j'ai obſerve un mélange particulier de ſubſtance griſe. Mem. de l'Acad. Scien. an 1781. p. 507.

† The medullary and cortical ſubſtance of white blooded animals preſent no difference of colour. *Cuvier.*

dullary

dullary matter, but to the manner in which the pia mater involves it. The medullary matter, being chiefly internal, has every where through the brain a communication from the fore to the back part, from the upper part to the bafe; from the great central part it extends in form of ftriæ, into the corpora ftriata and thalami; it invefts the eminences in the lateral ventricles; and thofe upper parts have communication with the medullary fubftance of the bafe.

M. Mickel found, upon comparing the brains of an European and of a negro, that the medullary matter differed very much in colour. In the negro, inftead of the whitenefs of the European, the medullary matter was of a yellow colour, and nearly like the cineritious matter: he obferved alfo, that this very peculiar diftinction of colour was only to be obferved when the fection was recently made, and that the darker colour of the medullary matter became fainter when expofed to the air *.

OF THE OBSERVATIONS MADE UPON THE MINUTE
STRUCTURE OF THE BRAIN.

THE opinions regarding the ftruĉture of the brain have had a dependence on the general doĉtrines of the ftruĉture of other fecreting organs, and it is, of courfe, connected with the difputations of Malpighi and Ruyfch, becaufe the doĉtrine of the glandular nature of the brain, and the belief of the nervous fluid, being a fecre-

* " La moelle du negre etoit d'un jaune clair, tirant un peu fur le
" gris, tandis que celle de l'Europeen etoit d'une parfaite blancheur."
" Celui du negre etoit d'un jaune noiratre et celui de l'Europeen
" d'une couleur blanche—Prolongeant enfui la diffeĉtion jufqu' aux
" grands ventricules du cerveau j'ai coupé horizontalement les corps
" ftries et les couches des nerfs optiques. C'eft la où la difference a
" paru vraiment etonnante, le corps ftrie dans le negre etant prefque
" de la couleur brune d'une ecorce d'arbre, au lieu que celui de
" l'Europeen etoit couleur de chair pale tirant au cendre," &c.

tion,

tion, has, in all ages, formed the bafis of the moft fa-
vourite theories *.

Malpighi found, on throwing in black and fluid in-
jection, that there remained always particles colourlefs,
and to which the injection did not penetrate. He con-
ceived thefe to be glandular folicules, and that the ci-
neritious fubftance of the brain confifted of this folicular
or glandular ftructure, while the medullary matter of the
brain was merely the fibrillæ of the excretory duct.
This opinion was founded on conjecture, with but a very
poor fhew of experiments, viz. by boiling the fubftance
of the brain in oil, he found it take a granulated appear-
ance, as if formed of fmall grains, or little glands †.

Such was the received opinion until Ruyfch, with a
defpotical authority, fwayed the opinions of phyfiolo-
gifts : he alleged, in proof only his own experiments
and preparations, in which other anatomifts could not
follow nor refute him, and therefore they acquiefced.
His moft unanfwerable and moft infulting argument was
" veni et vide ‡."

According to Ruyfch, the cortical fubftance of the
brain is entirely vafcular, and has no appearance of a
glandular or folicular ftructure; nay, he conceived it to
be entirely compofed of arteries §. This opinion Albinus

* Indeed this doctrine of the glandular nature of the brain has
defcended from Hippocrates— " Caput quoque ipfum glandulas habet
" cerebrum, enim eft ut glandula album eft et friabile," &c.

† " Pedamentum, fupra quod pofita eft philia in qua confervatur
" portio cerebri in liquore, quam decoxi in oleo olivarum per horas,
" ficuti, facere affolet Dr. Vieuffens. Ea autem plane *mutilis et per-*
" *verfa eft preparatis*, nam nihilum quidem vafculofi vifui occurrit
" poft decoctionem in dicto oleo, et quod unufquifque tentare poteft
" ita ut inventor neutiquam habendus fit Dr. Vieuffens Sc. quod
" cerebri cortex nil fit, nifi extremitates vaforum fanguineorum : in ea
" autem nemo hactenus (quod fciam) me imitari poterit aut anolo-
" gum quid fecit." Ruyfch Thef. An. x. No. xxxii.

‡ " Milites quando hoftium adventum audiunt, clament ad arma !
" ad arma ! fic ego dico hic ad vifum ! ad vifum !" Refponfio ad
J. Ch. Bohlium.

§ Vieuffens was latterly of the fame opinion, and is accufed of
plagiarifm by Ruyfch. Accordingly, we find, that in fome parts of
his works he defcribes the glands and ducts of Malpighi.

confuted,

confuted, and Malacarne obferves, though we fuppofe the extremities of the arteries of the cineritious fubftance to be more minute than thofe which are diftributed to the microfcopical corpufculi of the fmalleft vifible infect, there muft ftill remain fome part, which is not compofed of veffels ; and in regard to the veins of the cineritious fubftance we may appeal to Albinus, who, from the fubftance of the brain, finds many veins connected with the arteries of the cineritious fubftance when he carefully lifts the pia mater. But there is this peculiarity in the diftribution of the blood veffels of the brain, that, though the cineritious fubftance be the moft vafcular, yet, in the medullary matter, we fee the veffels with large open mouths, and more diftinct than in the cineritious fubftance. In following the blood veffels from the bafe of the brain into the medullary fubftance, we fee them diftinct, and of confiderable magnitude ; but when they are about to enter the cineritious fubftance, they difperfe into minute branches *. In the fame manner thofe arteries, which are carried into the fulci of the furface by the pia mater, branch into extreme minutenefs before they finally penetrate the cineritious fubftance †.

Leeuwenhoeck ‡ obferved, in the cortical fubftance of the brain, a pellucid, chriftalline, and to appearance oily matter : he calls this, therefore, the *fubftantia pel-*

* Leeuwenhoeck faw, in the fubftance of the brain, but efpecially in the cortical fubftance, red blood veffels, but fo delicate, that he could not comprehend how the globules of the red blood could pafs along them ; and what appeared more particular, they were of a deeper colour than the red particles themfelves ; for, when feen fingly, they appeared to have very little colour. This he explained by an experiment made upon a loufe. After it had fucked blood very plentifully, he obferved, that the blood was broken down by digeftion, and conveyed through the limbs and horns of the creature, fo as to make it univerfally red. So here he conceives that the globules of the blood may be broken down and altered in their fhape to enter the minute veffels of the brain.

† Malacarne, Part II. fect. 18.

‡ He was born in Delft in Holland, 1632, and died 1723. He is celebrated for his microfcopical difcoveries ; his papers are chiefly in the Tranfactions of the Royal Society of London, about the year 1674.

lucida

lucida et vitrea. When he had put a fmall portion of this under his glafs, he faw a fluid, which he at firft conceived might have efcaped from the globules that were neceffarily cut by the knife. This fluid alfo he found to confift of very minute globules, thirty-fix times lefs than thofe of the blood *. Thefe fmall globules he conceived to have probably conftituted a fluid, which, during the life of the animal, was moveable, and in veffels, though now in death congealed and fixed †. The colour of the cortical fubftance he found to depend upon the minute ramification of the veffels which were of a dark brown colour, while, in the medullary part, they were clearer and more tranfparent. Independently of this diftinction of veffels, he could obferve little difference in the medullary and cineritious fubftance; the refrac-tion of the rays of light amongft the tranfparent glo-bules being the caufe of the whitenefs of the former.

R. Della Torre ‡, in his microfcopical obfervations, defcribes globuli in the brain; he fays, that he faw them floating in a pellucid vifcous fluid. But Prochafka ‖ thinks Della Torre muft be miftaken in this, for when he took a fmall portion of the brain, he faw it confifting of innumerable globules, which continued to adhere to each other, even after three months' maceration in water: and thence he concludes, that it could not be as R. Della Torre conceived, that thefe fpherical bodies moved from the brain on towards the extremities of the nerves; nor do thefe bodies lie imbedded in a glutinous fluid (he continues) but they are connected by the ex-tremely minute and pellucid fepimentæ of the pia mater, and by the veffels which pervade both the cortical and medullary matter, and which nourifh as well as fupport and connect thefe corpufculi.

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* Anatomica Contemplatio, 30. Ridley Anat. Cerebri, cap. xi.
† Among thofe globules, of which the brain is compofed, he faw alfo globules of the blood, which it was eafy to diftinguifh by their roundnefs. Thefe red globules, he fuppofes, had efcaped in confe-quence of the minute veffels having been cut by the knife.
‡ Nuove Ofervazioni Microfcopiche, Napoli, 1776.
‖ Tract. Anatom. de Struct. Nervorum.

                                                       Fontana

Fontana *, on fubmitting a portion of the medullary matter to the microfcope, thought he difcovered it to confift of fmall winding tubes filled with a tranfparent gelatinous humour. This he chofe to call the inteftinal fubftance of the brain.

Prochafka † cannot, from his own obfervations, determine whether the globular bodies of Della Torre be convoluted veffels, or what they are. R. Della Torre had obferved, that they were largeft in the cortical part, lefs in the medullary fubftance, ftill diminifhing in the medulla oblongata, and leaft of all in the nerves ; but fucceeding obfervation did not fupport this affertion ‡. Malacarne expreffes himfelf to be nearly of the fame opinion in regard to the veficular ftructure of the cortical fubftance of the brain. The minute proceffes of the pia mater, fays he, embrace and fupport the medullary fubftance, which is furrounded with a matter of a darker colour, and lefs diftinctly fibrous, but not lefs effential, and which is compofed of corpufcules, that, in figure and arrangement, refemble the veficles of the pulp of a lemon §.

Many authors endeavour to fupport their conjectures regarding this veficular ftructure of the brain by morbid diffection ‖. We fee the brain frequently degenerated into hydatids, or into little veffels, or into knobular glandular-like fchirrofities. I have feen this veficular appearance in great portions of the pia mater. I have feen the pia mater with innumerable little bodies like miliary glands upon it ; and alfo the whole upper and external part of the brain degenerated into one mafs of difeafe. It was hard, fchirrous, tuberculated, and like

* Fontana's Treatife on Poifon, and on the Primitive Structure of Animals, tranflated.
† Profeffor of Anatomy at Prague.
‡ This was certainly a theoretical deception : it is like the accurate obfervation of Fracaffati, who could diftinguifh a difference of tafte in the medullary and cineritious fubftance of the brain.
§ Malacarne, page 2. fect. 4.
‖ Wepfer de Cicuta Aquatica. Mangetus.—Malacarne, &c.

a difeafed

a difeafed gland *. But I cannot conceive that any con-clufion, in regard to the natural ftruĉture of the brain, can be drawn from fuch appearances. They are to be confidered as the difeafes of the veffels and membranes, rather than of the peculiar matter of the brain.

When the brain is examined in the fœtus of the early months, although the fubftance of the brain is extremely foft, and even of a fluid confiftence, the membranes and veffels are fully formed, exquifitely minute, and perfeĉt in all their proceffes, fo that they give form and firmnefs to the brain. We fee, confequently, that the due increafe and complete organization of the brain is a gradual procefs, and like the growth of the other parts of the body.

OF THE SENSIBILITY OF THE SUBSTANCE OF THE BRAIN.

IT cannot but appear ftrange, that the very fource or centre, to which every fenfation is referred, fhould itfelf be deftitute of fenfation ; yet we are affured, by the experiments of Haller and Zinn, that the cortical fubftance of the brain has been irritated, without the animal being convulfed, or giving figns of pain † but when the medullary part of the brain is irritated, the effeĉts are inftantaneous, and the animal is convulfed. It has been obferved, that as the injury of a nerve caufes convulfions, fo does that of the central parts of the brain, from which the nerves originate ; but this fen-

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* There has been obferved a ftruĉture like the bronchial gland. Huber, Obfervationes Anatom.—Aĉta Helvetica, 1758. tom. iii.

† But, like the infenfible membranes, it becomes irritable by difeafe ; or by preffure, which affeĉts the univerfal funĉtion of the brain. Vander Linden, in his Medicina Phyfiologica (1613), brings proof of the infenfibility of the brain. See the general enumeration of the effeĉts of wounds in the brain. Haller Phyfiol. tom. iv. &c. Obfervations par M. de la Peyronnie de decouvrir la partie de cerveau ou l'ame exerce les funĉtions.—Acad. Roy. des Sciences. Boer-haave, tom. ii. ; with the Commentary of Haller, p. 595. for the effeĉts of preffure.

fibility

fibility * diminiſhes towards the ſurface of the brain †. We ſee a diſtinction betwixt the ſtructure and function of the nerves and of the brain ; or rather betwixt the cineritious ſubſtance of the brain and the nerves. For, although we muſt neceſſarily conclude, that the cineritious ſubſtance is an important, and, perhaps, the moſt eſſential part of the ſyſtem, ſtill it does not evince, by the immediate effect of injuries, that ſtrict ſympathy and univerſal connection which belong to the nerves.

The circumſtance has been thus explained. The nearer to its ſource that a nerve is pricked, the greater is the effect of the injury. As it recedes from the baſe towards the ſuperficies of the brain, the effect is leſſened, becauſe the connections of the part are diminiſhed in number, proportionally to their diſtance from the central parts of the brain ; a puncture in the centre injures more filaments from their being concentrated to form nerves. This reaſoning is not ſatisfactory.

Several ounces of the brain have been loſt in conſequence of wounds, without death, or loſs of memory, or intellect ‡.

There is a very marked diſtinction betwixt puncturing, cutting, or even burning, the ſurface of the brain, and preſſing it. In the firſt there is little or no effect, or even pain. In the latter there is ſtupor, pain, or convulſions. The reaſon is, that in the firſt it is a local irritation in a place which has little, if any, feeling, while in the latter, the effect of the preſſure ſpreads extenſively.

No ſenſible man will expect, in the moſt minute and unwearied inveſtigation of the ſtructure of the brain, to find the explanation of its function. It is intereſting to find effects ſo peculiarly connected with the operations of the mind, depending upon a ſtructure of ſo groſs and

* It is in effect different from pain or ſenſation : it ſhakes the body with violent convulſions.
† Sommerring, tom. iv.
‡ M. de la Peyronie had a patient who loſt a very large ſpoonful of brain, but whoſe life and intellects remained.

animal

animal a nature as this of the brain, but ſtill, all explanation of thoſe operations muſt be viſionary.

Circle of Willis

Carotid A.

Carotid A.

Baſilar Artery

Vertebral Arteries
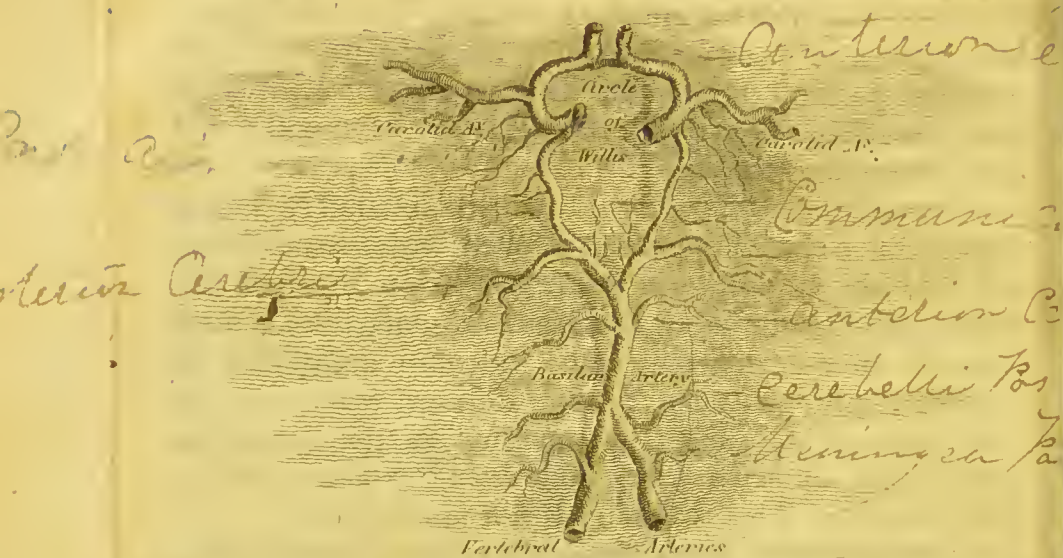
CHAP. II.

OF THE VEINS AND SINUSES OF THE BRAIN.

THE brain is very profuſely ſupplied with blood, in ſo much, that the blood has been ſuppoſed to circulate in the brain in a proportion four times greater than in any other part of the body. This is the moſt moderate calculation, and it has been formed from a compariſon of the quantity of blood circulating in the head, with that which circulates in the arm. Boerhaave and Kiel, comparing the area of the arteries of the cerebrum with that of the aſcending aorta, made a moſt erroneous calculation of the proportion of blood circulating in the brain, compared with that of the reſt of the body. Had they compared the quantity of blood within the head with that of the lungs, of the liver, of the ſpleen, or of the kidney, the difference would have been leſs ſtriking.

Wherever

Wherever there is great arterial vafcularity, we are fure to find alfo peculiarities in the venous fyftem of the part; wherever we find an accumulation of tortuous arteries paffing to a gland, we fhall alfo find the veins tortuous and large; or wherever the arteries of a part take a difeafed action, the effect of this action will be found moft perceptible in the change which the veins undergo. In fhort, the effect of difeafe is much more furely to be difcovered in the venous than in the arterial fyftem; and no where is this better exemplified than in the brain.

The following appear on the firft view to be the moft ftriking peculiarities in the veins of the brain; their fize; the little connection they feem to have with the fur-rounding cellular membrane, and the inconfiderable fupport which they appear to receive from it; their having no valves; their being in their courfe diftinct from the arteries; and laftly, their not being gathered into great trunks, but emptying themfelves into the finufes of the dura mater.

It is not eafy to conceive how the veins of the brain fhould have been fo much overlooked by the older ana-tomifts; but from the diffections of Albinus, and the microfcopical obfervations of Leeuwenhoek, we have authority for what is, perhaps, in itfelf fufficiently evi-dent, that the veins of the furface of the brain are de-rived from minute ramifications conveyed in the delicate pia mater; and that thefe, as in the other parts of the body, proceed from the extremities of the arteries, with-out any apparent peculiarity in the connection betwixt the extremities of the arteries and the veins of the brain *.

* The obfervation is trivial; but we muft recollect, that Vefalius contradicted Galen, and affirmed, that the finufes received alfo arteries which gave them their pulfation. This opinion was refuted by Fallopius, but adopted by Vieuffens, Wepfer, and others, upon the idea of the facility with which injection paffes from the arteries into the finufes. See Ridley, cap. vi, de Cerebri Motu, ejufque Sinubus.

The

The defcription of the veins of the brain, previous to their entering the finus, has been neglected. I divide them into the external and internal veins of the brain, or thofe which emerge from its fubftance, and are feen upon the furface; and thofe which, coming chiefly from the fides of the ventricles, are convoluted in the plexus choroides, and terminate in the fourth finus.

OF THE VEINS WHICH ARE SEEN UPON THE SURFACE OF THE BRAIN.

Vicq d'Azyr has been minute in his attention to the veins of the furface of the brain. He confirmed the obfervation, that almoft all the veins which pafs into the longitudinal finus, open in a direction contrary to the ftream of blood in the finus *. Thefe fuperficial veins of the furface of the hemifpheres, are in number generally from ten to fifteen on each fide. They really do not feem to be worthy of the minute attention which Vicq d'Azyr has beftowed upon them; he has moft carefully defcribed each individual branch, and that not in general terms, but firft thofe of the right, and then thofe of the left fide. Now, although thefe veins do not enter the finus oppofed to each other, nor in pairs, ftill the irregularity is trifling, and were it important, does not admit of defcription. Thofe veins do not lie in the

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* From Vicq. d'Azyr's table we fhould be led to conclude, that the veins did not decidedly all open with their mouths oppofed to the ftream of blood. Ridley afferts, that one half open backwards. Santorini alfo obferves great variation in the direction of thefe veins. Lower, while he obferved this direction backwards, defcribes them, at the fame time, as paffing obliquely betwixt the coats, like the gall duct in the inteftine, or the ureters into the bladder. Sabbatier fays decidedly, that they enter with their mouths oppofed to the courfe of the blood in the finus. From Malacarne, we fhould be led to conceive (what I believe to be the truth, that they open very irregularly. " Non tutte quefte vene fboccano obliquamente ad un " modo nel feno, come non a tutte la membrana interna del mede- " fimo fomminiftra quella valvuletta, che pure a mo' di lingua, di " briglia, di mezza luna frequentemente ne ottura la meta, il terzo, " o minor parte degli orifici." Malacarne, p. 94.

fulci

fulci of the brain, but pafs occafionally along the inter-
ftices, or over the convolutions of the brain; they take
in general a courfe from before backwards, but previous
to their entering the finus, are turned forwards. We
have already obferved, that the pia mater and dura mater
have no connection, but at the place where thofe veins
enter the lamina of the dura mater; and here their con-
nection is fomewhat peculiar. It is not a fimple adhe-
fion of the pia mater and dura mater; but a white
fpongy fubftance feems to connect and ftrengthen them,
and, when torn afunder, it leaves a foft fatty kind of
roughnefs upon the pia mater. Thefe appear to me to
be the fame bodies which Ruyfch fo frequently mentions
as little particles of fat, and which others have taken to
be the glands of the pia mater *. Vicq d'Azyr, in his
xxxiiid plate, fig. 14. has confounded them under the
name of the glandulæ Pacchioni †. Of thefe veins lying
upon the furface of the brain, there is one, or very
often there are two large veins on each fide, and which
enter generally pretty far back in the finus, and are
fomewhat peculiar from their greater fize, and their fe-
micircular courfe. Thefe, from their ftate of dilatation,
and the colour and fluidity of their blood, will be found
in morbid diffection, to mark fufficiently, in many in-
ftances, the character of the venous fyftem of the brain.
There is again another vein fomewhat peculiar in its
courfe: whilft thofe take a fuperficial courfe, and are

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* " Portio piæ matris in liquore; cujus fuperficies exterior obfita
" variis particulis prominentibus exiguis, quas pro glandulis habue-
" runt nonnulli: cum autem fint diverfæ formæ, et colore pingui-
" dinem repræfentent, pro pinguidine potius illas habeo, præfertim
" cum inter duplicaturam piæ matris aliquoties pinguidinem in-
" venerim." Thefaurus Anat. ix. N°. xlii. Epift. ix. p. 8. Thef. v.
N°. 1.

† We fee alfo what he fays in the Acad. of Sciences, An. 1781,
p. 502. " Elles étoient plus ou moins recouvertes, vers leur infer-
" tion par les glandules de Pacchioni; les ayant examinés dans plu-
" fieurs fujets, j'ai obfervé qu'elles étoient a peu-pres, de chaque
" côté au nombre de dix, douze, ou quinze." Ridley calls thefe
" carnous adnefcences," betwixt the membranes, p. 8. As to the
gland which Willis affirms to be fcattered over the tunica arachnoides,
I could never fee them. Ridley.

upon the level of the longitudinal finus, it gathers its branches upon the internal flat furface of the left hemifphere, and rifes fo as to infinuate itfelf into the inferior part of the finus *. All thefe veins of the furface of the cerebrum have very free inofculations with each other.

I cannot any where better obferve the negligence of authors, in regard to the glandulæ Pacchioni, than when fpeaking of the mouths of thofe veins which open into the great longitudinal finus.

I cannot help thinking, that many of our beft authors have overlooked entirely the importance of the glandulæ Pacchioni; and many alfo have been entirely ignorant of them. We have already mentioned, that a few fmall bodies, by no means conftant nor regular, were to be feen upon the external furface of the dura mater, in the courfe of the longitudinal finus, or at no great diftance from it. We have mentioned alfo thofe fatty-like adhefions of the roots of the veins, as they enter the finus, and which rather belong to the pia mater. Both thefe are called the glandulæ Pacchioni improperly. The bodies which engaged Pacchioni and Fautonus in fuch violent difputes, are feen on the infide of the longitudinal finus, and are connected with the opening of the veins †;

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* Vicq d'Azyr.

† " In longitudinali finu, immediate, fub membranofis expanfioni-
" bus, in areolis chordarum Willifianarum, quin et fupra eafdem
" chordas confitæ funt innumeræ glandulæ conglobatæ, propria, et
" tenuiffima membrana, veluti in facculo conclufæ; quæ racematim
" ut plurimum coeunt; raro fparfim difponuntur: hæ glandulæ
" utrinque ad latera falcis mefforiæ, ab ejufdem apice ad bafis ufque
" pofticam partem miro prope modum artificio procedentes, dorfo
" lacertorum accumbunt, & partim ab horum fibris, partim ab iis,
" quæ a chordis emergunt, firmantur, atque invicem alligantur, ita
" ut non nifi lacerat acu disjungi poffint." Vide Pacchioni, p. 126.
" Sinu longitudinali aperto, in confpectum veniunt corpufcula ro-
" tunda, & fubrotunda, milii forma, (a clariff. viro Pacchiono de-
" tecta) hæc magnitudinem aciculæ vulgaris caput haud fuperant,
" nifi per microfcopium introfpiciantur, aut ex duobus corpufculis
" combinentur." Ruyfch, Thef. vii. N° xxxiv. From this we fee
how various the fize of thefe bodies is. In the next paragraph
he obferves, " Vix et ne vix quidem ullum ex dictis corpufculis
" videre poteft."

they

Longitudinal Sinus laid open from . . . .

An Accurate Copy of Pacchioni's Plate of the Glands.
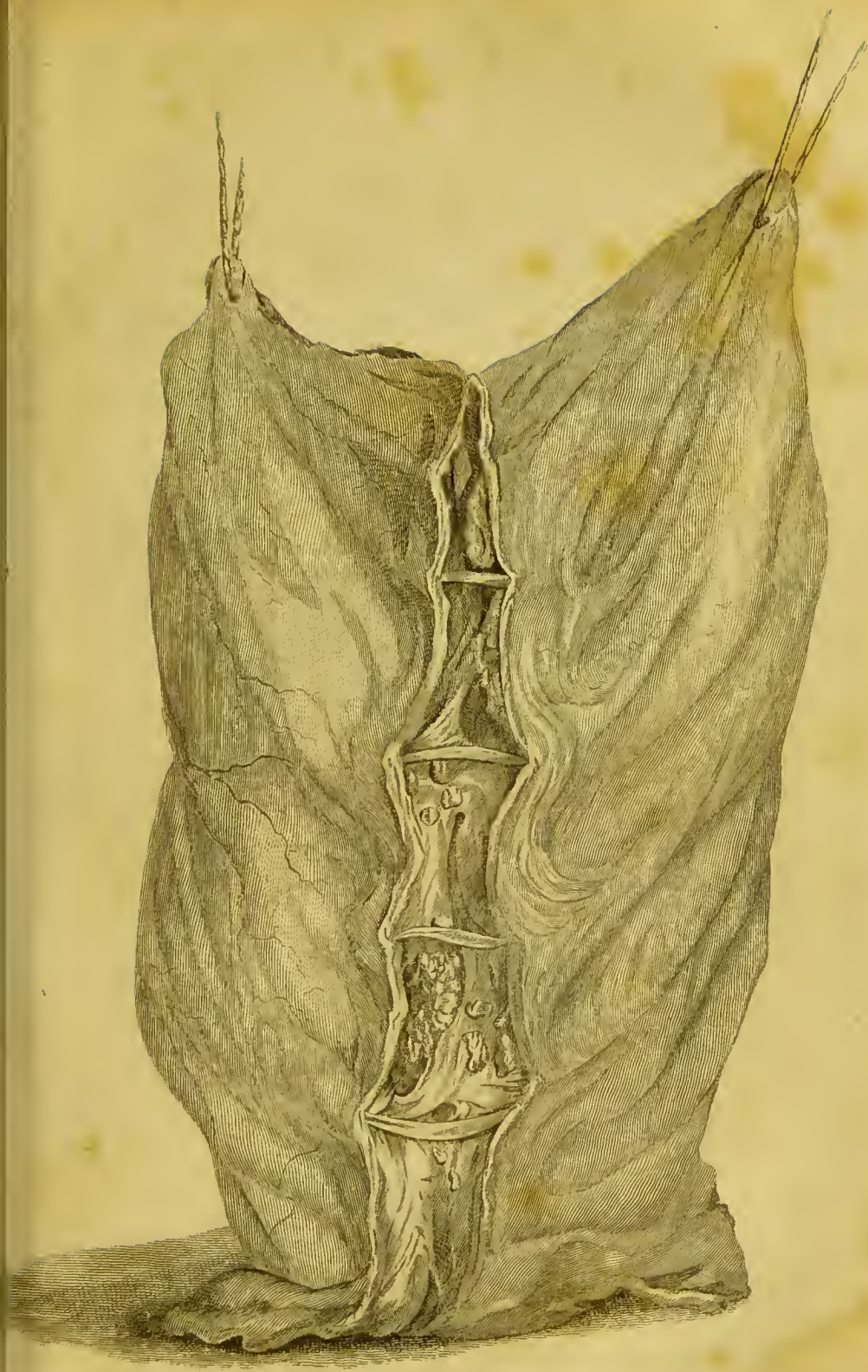
they appear of a flefhy colour, projecting like papillæ, or like the granulations of a fore. Pacchioni fays, " Ovorum inftar bombycinorum apparent," which defcribes their conglobate appearance; but they are of a pale flefhy colour, which Pacchioni fays is owing to their being furrounded with mufcular fibres. I have added the plate of Pacchioni, and contrafted it with a more natural drawing of them. The preparation from which Pacchioni had taken his plate, was previoufly macerated in vinegar. Thefe bodies being foft and vaf-. cular, have allowed the minute injection to tranfude in fome of the experiments of anatomifts, which has given rife to the opinion of the actual communication of the arteries of the dura mater with the finufes. As to their ufe *, I am in confiderable doubt. Joan. Fautonus (in his letters to Pacchioni) conceives that they give out a fluid into the finus, to dilute the venous blood †. Pacchioni defcribes ducts paffing from them to the pia mater, (which are thofe connections that we have already remarked,) and conceives that they lubricate the furface, or communicate with the fubftance of the brain; and that they are preffed, and their fecretion promoted by the motion of the chordæ Willifianæ, and the action of the dura mater ‡.

I fhould rather conceive that they had a valvular action on the mouths of the veins; they project from the mouths of the veins into the finus, and the blood paffing from the veins muft filter through them, and be checked in its retrograde courfe, and perhaps ob-

* It is curious that thefe bodies are confined to the longitudinal finus. " Mirum, & æque animadverfione dignum eft, hafce glan- " dulas ad folius longitudinalis finus latera reperiri cum in lateralibus " finibus vel nunquam, vel raro admodum per pauca earundem " veftigia adnotentur, ubi præfertim præfati canales deorfum incli- " nare incipiunt, antequam ab interfeptorum dorfo difcedant." Pac-chioni, p. 127.

† " Ego aqueum humorem in glandulis egregari, fluere lympham " in tubulis, quos tecum lymphaticos appello, nunquam negaverim, " fed liquidi fluxum ab utrifque verfus finum magis, quam verfus am- " bitum cerebri verifimilem, magifque naturæ legibus confonum effe " affirmo. Fautonus Epift. D. A. Pacch. Oper. Pacch. 177."

‡ " Ex iis autem in minimum quidem vafculum lymphaticum pro- " dire confpicere potui." Ruyfch.

ftructed

ſtructed in its natural courſe when they are enlarged.
As theſe bodies differ very much in the variety of ſub-
jects, they muſt ſometimes impede the free egreſs of the
blood from the veins of the cerebrum into the longi-
tudinal ſinus, and cauſe diſeaſe, eſpecially as they are
ſofter and larger in old men *. At all events, they are
too much overlooked in morbid diſſection.

The veins which anſwer to the arteria corporis calloſi,
and which are ſeen lying upon the corpus calloſum in
a very fine cellular membrane, riſe and paſs into the
inferior longitudinal ſinus, that which is formed in the
lamina of the inferior edge of the falx.

OF THE INTERNAL VEINS OF THE BRAIN AND OF THE CHOROID PLEXUS.

UNDER this title of the internal veins of the brain,
the choroid plexus comes naturally to be conſidered.

the Choroid Plexus & Vena Galeni, taken from the
Brain & Spread ſo, as to Show their Connection.
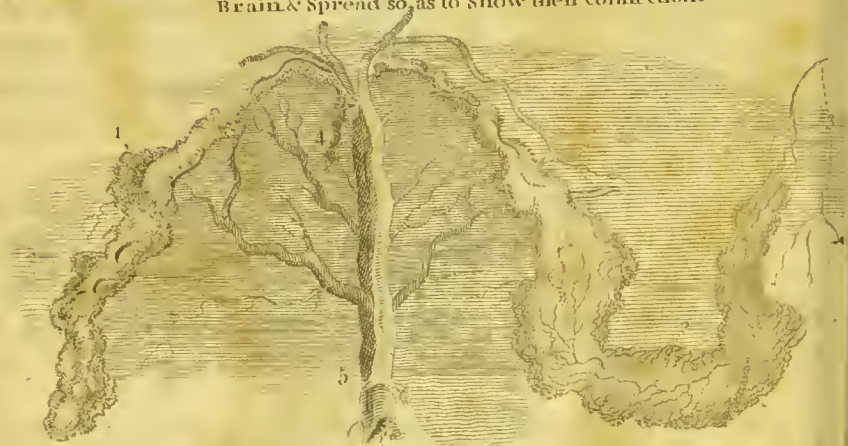
1 Choroid Plexus of the right Side 2 Plexus of the left Side Spread out 3 Arteries to the
part, where it lies in the interior horn 4 Plexus of the 3.ᵈ Ventricle formed by the ſame
of 1, 2, 5. Vena Galeni

N. Lizars. ſculp.

* Fibris carneis tenuiſſimis circumambiuntur ſingulæ, unde co-
" lorem carneo-pallidum nancifci videntur: in ſenibus vero, in qui-
" bus hujuſmodi fibræ enervatæ nimis laxantur, et ferme diſparent,
" glandulæ albeſcentes, & magis turgidæ cernuntur: quod, & in
" hydrocephalicis, comatoſis, & id genus aliis obſervari poſſe arbi-
" trarer." Pacchioni Oper. p. 126, 127.

The

The moſt remarkable thing in the ventricles of the brain is, that they have lying in them this very peculiar vaſcular ſtructure, the choroid plexus. The lining membrane of theſe cavities is extremely thin and ſmooth, inſomuch, that ſome anatomiſts have denied its exiſtence; but through the whole ventricle there run certain folds or plaits of this membrane, which are ſo loaded with veſſels as to reſemble a fleſhy ſubſtance, and to loſe altogether their reſemblance of the lining membrane. The plaits, before they are unravelled, look like maſſes of tortuous veſſels, lying looſe and unconnected in the bottom of the ventricles.

The largeſt portion of each choroid plexus comes up from the inferior horn of the lateral ventricles; they then run forwards. In each ventricle they lie in the groove, betwixt the thalamus nervi optici and corpus ſtriatum: and cover the tenia ſemicircularis geminum. The two plexus of the lateral ventricles unite under the anterior crus of the fornix, and form a ſmall plexus, which is continued upon the inferior ſurface of the velum interpoſitum, and even into the third ventricle. Again, there is a plexus which lies in the fourth ventricle. Vicq d'Azyr alſo deſcribes, as occaſionally occurring, little inſulated plexus attached to the veins, branching on the corpora ſtriata *. Thus each diviſion of the brain has its choroid plexus.

These vaſcular webs muſt have an important uſe. I ſhould conceive that they chiefly ſecreted the fluids of the ventricle; for I believe the tortuoſity to be the moſt unequivocal mark of the activity of veſſels. This opinion, however, is nothing new †. Another prevailing

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* " Sur le côte des ventricules latéraux, j'ai quelquefois obſervé " de petits plexus choroides iſolés, que accompagnoient quelquefois " de ces rameaux des veins de Galien, que l'on voit paſſer ſous le " tænia ſemicircularis, & s'etendra ſur le corps ſtrie." Vicq d'Azyr. Memoir. l'Acad. Roy. 1781, p. 540.

† The ſuppoſed glands of the plexus choroides were conceived to ſecrete the fluid of the ventricles. Where the plexus lies upon the poſterior crura of the fornix, it is often diſeaſed, having knots like glands, or, being raiſed into veſicles, like hydatids. " Eas bullas

" humorem

ing idea was. that the blood accumulated in thefe convoluted veffels, occafioned fuch a gentle continued heat as favoured the circulation of the fpirits through the cavities of the brain, and preferved the fluidity of the water of the ventricle *.   Great variety of opinions have prevailed regarding the ftructure of thofe bodies.   We fee them confifting of knots of convoluted veffels ; chiefly veins ; or thefe at leaft are moft evident from their fize, and the colour of their blood.   Thefe convolutions of veffels are by many good anatomifts defcribed as glands. Varolius, Sylvius, Wharthon, Willis, Santorini, and Lieutaud, confider them as fuch †.   Three fets of ARTERIES pafs up to the PLEXUS CHOROIDES, from the bafe betwixt the crura of the brain ; they come, 1ft, from the curve of the internal carotid artery ; 2d, from the communication betwixt the bafilar and carotid artery ; 3d, from the bafilar artery, and moft pofterior part of the branch of communication.   Thefe arteries, which are fmall, are convoluted into great minutenefs ‡

" humorem ventriculorum fecernere olim conjectura fuit.   Verum " vitio cum nafcantur vix perpetuum habitum generare idoneæ erunt."' Haller, tom. iv. 48.

* See Duverney, tom. i. p. 55.   " Ut enim fanguis intra finuum " cavitates aggeftus, Balnei calidioris vicem preftat, quo fpiritus " animales in extima et corticali cerebri parte uberius diftillentur : " ita fanguis intra plexus hujus vafa exilia contentus, quo iidem fpiri- " tus in penitiori ac medullari fubftantia idonei circulentur, Balnei " minoris, & magis temperati loco effe videtur."   Willis Cerebri Anat. p. 47.

† Galen gives a good defcription of the choroid plexus ; he de- fcribes the innumerable veins of which it is compofed, and their join- ing the fourth finus by the vein which retains his name.   Some have confufed themfelves with a paffage of Ruyfch. Thef. iii. No. lxv, &c. in which he is fpeaking of the choroid plexus, where it appears in the bafe of the fcull, from the bottom of the fourth ventricle. They have underftood him to fay, that the plexus was covered, not with the pia mater, but with the tunica arachnoides, firft defcribed by Morgagni, and whofe authority we may confult for much of this part of anatomy.   Adverfar. Anat. vi. Animad. 1. & fequent.

‡ " Huncce plexum nil effe nifi arteriolas, ad vifum fuccofas, a " naturali conftitutione arteriofa non nihil recedentes, mirumque in " modum contortas, ferpentinoque modo reptantes, glandulafque " reprefentantes." Ruyfch, Thef. v. Affer. quartus, N° lxviii. Not. 2.

in

in the membrane, and their blood is returned by veins, which taking a very tortuous courfe, feem to entangle their branches, and form a mefh of veins.

The blood of the two plexus of the lateral ventricles, and that of the third, is conveyed into the velum inter-pofitum, or that membrane which ftretches under the fornix, and over the third ventricle. The branches of veins alfo which extend themfelves upon the fides of the lateral ventricles, and into the proceffus digitalis, being gathered together upon this membrane, open into the vena galeni, or rather form it.

The moft remarkable branches of veins in the lateral ventricle are thefe : A confiderable branch is feen to collect its branches upon the anterior part of the ventricle, and in the anterior finus, or horn of the ventricle. This vein runs back towards the anterior crus of the fornix, and dips under it, juft above the communication of the ventricles ; and joins the veins in the velum of Haller. Other fmall veins are feen collecting their branches upon the corpora ftriata ; and, paffing under the centrum femi-circulare geminum, connect themfelves with the plexus. Again feveral branches of veins are extended in the pofterior part of the ventricle. Thefe are from the medullary fubftance of the pofterior lobe of the cerebrum. They pafs under the pofterior crus of the fornix and join the vena galeni. Laftly a vein remark-ably tortuous, frequently full of blood, paffes forward and is feen at intervals in the plexus choroides. This vein tak-ing an acute turn, joins its fellow under the anterior crura of the fornix and is reflected backwards and under the for-nix, fo as to form the beginning of the vena galeni.

The VENA GALENI then is the great central vein of the brain. It ftretches from the extremity of the fourth finus into the internal part of the brain, to receive the blood from the membrane lining the ventricles,—from the fubftance of the brain,—from the plexus choroides, —and from the velum interpofitum *. It lies under the

* The velum lying upon the nates and teftes, and adhering to them and the pineal gland, the vena galeni receives here alfo veins from thofe bodies, and from the upper part of the ccrebellum.

posterior part of the corpus callosum, under the fornix and above the nates and testes. It is entangled in the velum itself. It consists of two great branches which lie parallel to each other, and which sometimes have the appearance of being twisted, and these unite before they enter the fourth or straight sinus.

In the BASIS of the BRAIN the veins are not remarkable nor do they require any description distinct from the sinuses into which they open.

They are small, having little way to run ; and before they become large trunks, they empty themselves into the numerous lesser sinuses betwixt the dura mater and base of the scull. This is perhaps a provision against the pressure of the brain. In passing into those sinuses, the veins take a long oblique course betwixt the lamellæ of the dura mater ; which has given occasion to anatomists to describe many intricate lesser sinuses.

OF THE PARTICULAR SINUSES.

By the term sinus we are to understand the great veins of the brain, where they are received into the triangular canals of the dura mater.

SUPERIOR LONGITUDINAL SINUS.

THIS is a triangular channel, running in the falx from the crista galli of the æthmoid bone to the crucial ridge of the occipital bone. It is not constant in its origin. Sometimes it begins from a blind foramen before the crista gilla *. Sometimes from the orbital sinus †. In some subjects it begins only opposite to the fontanelle, or even further back, and then at once swells out to a large size.

. * Malacarne, Haller, Gautier.

† These sinuses as frequently are continued into the inferior longitudinal sinus or into the circular or elliptical sinus ; they are like azure streaks under the dura mater, covering the orbital process.

As

As the finus paffes backwards it is gradually enlarging for the reception of the veins from the furface of the cerebrum. As we have already demonftrated by the marginal plate of the fection of the longitudinal finus (page 368), the bafe of the angle is curved, anfwering to a fulcus, which runs in all the length of the cranium, from the æthmoid bone to the crucial ridge of the occipital bone. The lateral planes are drawn tenfe and converge into an acute point; the angle formed by the fplitting of the internal layers of the dura mater, is ftrengthened by ftrong flips of fibres, which upon the infide of the finus have the effect of making it irregular, and in fome degree having the appearance of cells, into fome of which cells the probe enters, and leads to the veins on the furface of the brain; others are blind, or lead to leffer finufes, which not unfrequently run parallel for fome length to the great finus; or the probe paffes from one of thefe cells to another. Sometimes, however, the finus has no fuch irregularities, but is ftraight and fmooth through its whole length *.

This finus has in fome rare inftances been found of a fquare fhape; its lower furface ferving as a roof for another finus of a triangular form, which, for fome way, ran parallel with the great finus, and which was of courfe alfo included in the lamina of the falx—thefe Malacarne calls feni fubalterni. Irregular leffer finufes are by no means uncommon, and they form, fometimes, communications through a great extent of the longitudinal finus; or again it will be found that the longitudinal finus deviates confiderably, in fome fubjects, from the ftraight line, taking a curve or circle, generally behind the fontanelle; or it fends off branches, which again unite with it; or it is fairly divided. In all thefe cafes the chords or fafciculi of the dura mater ftretch out over the finufes, and protect them from compreffion.

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* The internal membrane of the finus is perfectly fmooth, and is continued into the coats of the internal jugular veins; it is of the fame nature with the internal coat of the vein.

Inftead

Inſtead of reaching backwards to the crucial line upon the occipital bone, the longitudinal ſinus has been found to divide at the beginning of the lambdoidal ſuture, and to follow them in a direction towards the petrous bone *, while the lateral ſinuſes, running in the duplicature of the tentorium, were reduced to a very narrow compaſs.

From the ſtrength of the connections of the ſinuſes, and from the languid courſe of the blood through them, I ſcarcely believe that the ſinus has ever ſuffered the diſtention, which Malacarne deſcribes in ſome caſes. I ſhould rather ſuppoſe that what he mentions had been natural and congenital enlargements ; eſpecially conſidering that the ſinuſes, like the other veins of the body, are very apt to be irregular.

LATERAL SINUSES, OR THE FIRST AND SECOND OF THE ANCIENTS.

THE lateral ſinuſes are formed by the ſplitting of the lamina of the tentorium, as the longitudinal ſinus is by that of the falx. From the crucial ridge of the occipital bone they ſtretch nearly horizontally ; following the connections of the tentorium in a direction toward the petrous bone ; then they take a curve downwards and forwards, to terminate in the internal jugular vein ; paſſing through the foramen lacerum betwixt the temporal and occipital bones.

Very frequently the one lateral ſinus is larger than the other——generally the right is the larger, and ſometimes the left is entirely wanting †.

They diverge from the termination of the ſuperior longitudinal ſinus at the crucial point of the occipital bone : but ſometimes they are irregular, diverging higher, and even paſſing round in the circle of the poſterior part of the cranium, at ſome diſtance from the tentorium ‡.

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* Malacarne, part i. 148.　　† Lieutaud, Anat. Hiſt.
‡ Malacarne.

The

The right lateral finus for the moft part begins higher than the left. It is generally longer, and may be confidered as the continuation of the longitudinal finus. Nay, in fome fubjects, the right or left lateral finus begin from the longitudinal one, while that of the other fide is continued from the fourth, or the torcular hierophili ; and the lateral finufes are feparated at their origin by a membranous ifthmus—if it fhould happen that the left lateral finus receives the fuperior longitudinal one, it would be found to be four times the fize of the right ; fometimes, alfo, the longitudinal finus, turning to the right, is continued into the finus of that fide ; and the left lateral finus opens or begins by two or more irregular holes *.

I have feen a more remarkable variety of the lateral finufes. The blood which fhould flow from all thofe parts of the brain from which the fuperior and inferior longitudinal finus, and the vena Galeni, and fourth finus are derived, feemed, inftead of paffing by the root of the tentorium, to have forfaken thefe channels ; the lateral finufes were left diminutive ; and the blood had taken a courfe in the tract of the pofterior occipital finufes, and, after incircling the foramen magnum, it gained its ufual outlet †.

The angles of the lateral finufes are ftrengthened by membranous fafciculi ; betwixt thefe the veins enter as in the longitudinal finus ; where the finus defcends from the level of the tentorium in the angle formed by the occipital and petrous bones, there are many ftrong irregular fafciculi of fibres : under this point, being no longer protected from compreffion, by their triangular fhape and the tenfion of the tentorium, the finufes are irregular ; they are now funk in the fulci of the bones, and the dura mater fpreads its fheath over them.

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* See Morgagni Adverfaria VI. tab. i. fig. 1.

† There are inftances of the lateral finufes opening into the external jugular vein.

The great irregular cavity*, in which the extremities of the lateral finufes lie †, and the foramen lacerum have much variety, and their ftraightnefs feems to affect the fize of the finus in its whole length ‡.

OF THE INFERIOR LONGITUDINAL SINUS.

THE inferior longitudinal finus, or the leffer, or inferior finus of the falx, runs in that edge of the falx which penetrates betwixt the hemifpheres of the cerebrum. It is extremely fmall towards the fore-part of the falx; but, as it paffes backwards, it goes on increafing by the acceffion of veins which come from the hemifpheres, and corpus callofum, and from the falx itfelf. It is formed betwixt the lamina of the falx. Sometimes it runs in its very edge, but as frequently a little way removed from it; fometimes it is found beginning very far back in the falx. The fore-part of it is more like a vein running in the falx than a finus. It is in general to be feen more fuperficial, and in every refpect like a vein, (there being no provifion for preferving it from compreffion,) upon one fide of the falx. It very often takes a waving courfe upon the falx; while it receives veins, which branch in the fubftance of the falx, and form communications betwixt it and the fuperior longitudinal finus. It opens into the ftraight or internal finus, near the edge of the tentorium.

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* Lower conceives that the fize of the jugular foffa was the effect of the reflux of the blood; and that the greater fize of the finus of the right fide was to be traced to the practice of nurfes laying their children chiefly on the right fide! See alfo Morgagni Adverfaria Anat.

† See Willis Anatom. Cereb. Hum. p. 29, and the plate.

‡ Some very large veins open into the lateral finus; they are derived from the pofterior lobes of the cerebrum and the cerebellum. Thefe infinuating irregularly betwixt the lamina of the tentorium, and running for fome way, have been confidered as additional finufes. See Haller, tom. iv. p. 149.

OF

OF THE INTERNAL, STRAIGHT, OR FOURTH SINUS [*].

I WOULD call this the internal finus, from its fituation, but more particularly from its receiving the veins from the internal part of the brain. This finus is formed chiefly by the vena galeni; which, coming out from betwixt the corpus callofum and tubercula quadrigemina, enters betwixt the lamina of the middle part of the tentorium, where it is united to the falx; fo that by the tenfion of thefe two partitions this finus is drawn into a triangular form, and is as incompreffible as thofe finufes which run connected with the bone.

It opens, for the moft part, by an oval mouth, formed by ftrong pillars of fibres, into the left lateral finus, rather than directly in the middle of the communication of the three great finufes. We fhall find this like the other finufes fuffering confiderable variety; or irregular fmaller finufes will often be found running betwixt the lamina of the tentorium.

POSTERIOR OCCIPITAL SINUSES.

THESE are fo called in oppofition to fome irregular and fmall finufes, which run upon the occipital bone before the great foramen. THE POSTERIOR OCCIPITAL SINUS lies in the little falx of the cerebellum; it rifes upwards, and opens into the common union of the longitudinal and lateral finufes; it commonly, however, lies rather to the left, and empties itfelf into the left lateral finus. It is by no means [†] conftant; like the other leffer finufes it is fubject to great variety; and, before it rifes into the tentorium, or empties itfelf into the larger finufes, it has a communication or emiffarium, by

[*] Sinus quartus, Perpendicularis. Haller—The fourth finus; the two lateral being the firft and fecond, and the longitudinal being the third finus.

[†] Vicq d'Azyr.

which

which part of the blood may pafs into the external veins, through a foramen in the centre of the occipital bone *.

<p style="text-align:center">THE INFERIOR LATERAL SINUSES.</p>

THE inferior lateral finufes are ftill more rarely to be found than the laft, in fo much that Vicq d'Azyr fays he never has feen them. They run in the lamina, or under the dura mater of the pofterior fofla of the bafe of the fcull; that is the hollow of the occipital bone, which is under the tentorium. They are fo irregular that they frequently occur in one fide only. They communicate with the pofterior part of the foramen lacerum ; with the pofterior petrous finus or vertebral veins ; or laftly they occur as an irregular collection of channels running in the feveral neighbouring finuofities †.

We fee then that there is a point of union for all thefe finufes, which we have not as yet defcribed: we fee that the fuperior longitudinal finus, the two lateral finufes, the fourth (and confequently the inferior longitudinal finus), and the pofterior occipital finus, unite at the crucial fpine of the occipital bone. This is the torcular hierophili ‡, torcular, lacuna, platea, tertia vena, palmentum, pelvis, laguncula. It was natural that the attention of the ancients fhould be drawn to this part ; for, upon opening this union of the finufes, we find a large

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* Malacarne.—This finus is fometimes double; or it has two branches encircling the pofterior margin of the occipital hole ; or, as I have already obferved, it takes the office of the great fuperior lateral finufes, and empties it into the foramina lacera ; or they communicate with the vertebral veins. See Obfervations fur un dilatation fingulière des finus occipitaux, Mem. de l'Acad. Roy. Anno 1781, p. 596.

† " Independente dai feni lateralia inferiori ho veduta tra le robufte " lamine e le fibre, dalle quali incomincia craffiffimo l'imbuto verte- " brale intorno al maggior foro del cranio una quantita di caverne, di " cellule communicanti infieme, le quali formavano un feno circolare " irregolariffimo appoggiato fulla parte fuperiore, o fia ful margine " interno del foro medefimo." Malacarne, p. 113, 114.

‡ Hierophilus was a Greek phyfician, a difciple of Praxagoras, and cotemporary with Erafiftratus.

<p style="text-align:right">irregular</p>

irregular cavity, which feems to be particularly ftrength-
ened by thefe ftrong fafciculi of fibres, which form
the fupport of the finufes *. Ignorant of the circula-
tion, imagining that the blood afcended by the great
jugular veins to the lateral finus, and feeing that the la-
teral finufes opened into this central cavity, they con-
ceived that the blood deftined for the brain underwent
an operation there, and was thence fent through every
part of the brain †.

OF THE LESSER SINUSES IN THE BASE OF THE SCULL.

BESIDES thofe larger finufes which we have defcribed,
and which convey back the great proportion of blood
circulating in the brain, there is a fet of leffer finufes
which lurk betwixt the dura mater and the anterior part
of the bafe of the fcull. Thefe laft are fully more intri-
cate than the others; they lie upon the irregular fur-
face of the fphenoid, temporal, and occipital bones;
and tend backwards to the great embouchoir formed

* " Deinde et illia per fectionem fcalpellum injiciens, furfum adi-
" gere conoberis ad ufque verticem ubi venæ duæ invicem congredi-
" untur; quam regionem Herophilus nominat lenon, torcular. Galen."
Lib. Nonus de Cerebri, &c. Diffectione.
† " Coeuntes autem in vertice capitis, quæ fanguinem deducunt
" meningis duplicaturæ, in locum quendam vacuum quafi cifternam
" (quem fane ob id ipfum Herophilus torcular folet nominare,) inde
" velut ab arce quadam omnibus fubjectis partibus rivos mittunt;
" quorum numerum nemo facile dixerit, quod partium nutriendarum
" numerus fit infinitus. Manant autem rivorum nonulli quidem ex
" medio ipfo loco in totum cerebellum, fecti, ac derivati, codem pror-
" fus modo, quo ii qui in areolis, alii autem ex parte anteriore ferun-
" tur, ea fcilicet qua torcular excipit dixeris utique velut rivum quen-
" dam fanguinis, quem et ipfum ex craffa meninge admodum ingeni-
" ofe fabricata eft, partibus enim ipfius meningis quæ fanguinem
" duxerunt ad torcular appulfis, dimiffaque illinc aliqua in partes fub-
" jectas, non amplius, quod fuperarat, uni venæ concredidit, fed
" preterea ex craffæ meningis partibus anterioribus extenfis rivulum
" efficit, ex quo primum multos rivulos per totam viam produxit."
Galen, cap. vi. de torcular. Et quo pacto venæ intra cerebrum diftri-
buantur.

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by

by the irregular hole in the temporal and occipital bones.

THE SPHENOIDAL SINUSES.

THE SUPERIOR SPHENOIDAL SINUSES are feated in a fold of the dura mater, on the internal margin of the wing of Ingraffias, and before the great wing of the fphenoid bone; they receive the blood in part from the orbit and from the dura mater; they open into the cavernous finus, or perhaps into the opthalmic finus, which of courfe, for the moft part, conveys the blood into the fuperior or inferior longitudinal finus.

The INFERIOR SPHENOIDAL SINUS is very irregular and inconftant. It is in the dura mater, covering the great wing of the fphenoidal bone: the blood of this finus is emptied into the cavernous finus, or efcapes by emiffarii into the trunk of the temporal veins.

The ANTERIOR CLYNOID SINUS.—The pofterior clynoid finus, or eliptic finus, and the circular finus, are one and the fame; the difference confifts only in the manner of defcribing them; the CIRCULAR SINUS lies within the clynoid proceffes of the fphenoid bone, and furrounds the glandula pituitaria *.

As this circular finus opens upon each fide into the cavernous finus, it is not unaptly divided into two; the anterior half of the circle, being the anterior clynoid finus of fome authors; the pofterior half (which is in

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* Ridley defcribes it in thefe words: " Another I difcovered by " having injected the veins with wax, running round the *pituitary* " *gland* on its upper fide, forwardly within the duplicature of the " dura mater, backwardly between the dura mater and pia mater, " there fomewhat loofely ftretched over the fubjacent gland itfelf, " and laterally in a fort of canal made up of the dura mater above, " and the carotid artery on each outfide of the gland, which, by " being faftened to the dura mater, above and below, at the bafis of " the fcull,leaves only a little interftice betwixt itfelf and the gland." (Accuratius tamen a Rilleyo defcriptus eft. Haller.)

But Ridley is affuming merit to himfelf. Brunnerus defcribes this finus.

general

general wider), the eliptical or pofterior clynoid finus, or femilunar.

This finus, like moft of the leffer finufes, is irregular in its fhape, its fize, its communications, and its origin*. Its natural communication is with the cavernous finus, which in fact encroaches upon its fide; it will be found to communicate alfo with the fphenoidal finufes, and the obliqui or petrous finufes †: at one time the anterior half of the circle is wanting; at another the pofterior ‡.

THE CAVERNOUS SINUS.

THE cavernous finus is a great irregular centre of communication with the leffer finufes in the bafe of the fcull. This finus is funk upon each fide of the fella turcica, and is formed in the irregular fplitting of the lamella of the dura mater: it is of a triangular fhape; it extends from the fides of the fella turcica, even to the foramen fpinale §. The pointed extremity of the tentorium, which extends forwards from the angle of the petrous bone to the pofterior clynoid procefs, covers and protects it. The cavernous finus is different from all the others; it is an irregular cavity, full of fibrous cords traverfing it, which gives it a kind of cellular appearance. It is like a difeafed part into which the blood had been driven, till the cellular texture had been diftended and partly deftroyed. After a minute injection, fmall arteries are feen to ramify among thefe fibres; the internal carotid artery rifes through it, and the fixth pair

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* " Varie fono le origini, e le foci di quefto feno. Alcune volte il " fondo della foffa pituitaria vi invia due canaletti longitudinali, che " fcorrono ful dorfo di quelle due pieghe fottili falcate ond-iè tripar- " tita la glandula pituitaria. Altre volte la foffa divifa per traverfo " da una fimil piega che pure ha ful dorfo il fuo feno, allo elittico lo " invia." Malacarne, p. 123.

† Haller, tom. iv. p. 154.

‡ " Nunc anterior nunc pofterior ejus arcus amplior eft; nunc an- " terior nunc pofterior ejus arcus deficit; nunc totus ipfi defidera- " tur; interdum vere duplicem fuiffe, referunt." Sommerring, vol. v. p. 354.

§ Malacarne.

of nerves is involved in it, in their paſſage from the ſcull.

This ſinus is the centre of the little ſinuſes and veins of the anterior part of the baſe of the brain and cranium : four or five veins pour their blood into it, from the anterior lobes of the brain and the foſſa ſilvii ; ſometimes, even the opthalmic veins open into this receptacle *. The ſuperior and inferior petrous ſinuſes, and the baſilar ſinus, open into it behind ; the circular before ; the ſphenoidal ſinuſes and veins of the dura mater upon the ſide ; while the right and left ſinuſes often communicate by means of the tranſverſe ſinus. Beſides theſe the petrous ſinuſes have ſeveral communications, or emiſſaria as they are called, viz. by the inferior orbitary foramen, the funnel of the carotid artery, through which deſcends a vein, (the vena ſodalis carotidis,) which terminates in the pterigoid plexus of veins, the ſphenoidal fiſſure, the interoſſeous ſinus of Malacarne †.

The TRANSVERSE, or POSTERIOR CLYNOID SINUS, runs acroſs from one oblique ſinus to another behind the poſterior clynoid proceſſes ‡. In its form it is not peculiar, nor is it very regular.

There are two PETROUS SINUSES, the anterior and poſterior, or the inferior and ſuperior ſinuſes ; theſe two come off nearly together from the carvernous ſinus, and running back upon the petrous bone, terminate in the lateral ſinuſes or beginning of the internal jugular vein ; but which two to take as petrous ſinuſes is a queſtion. For example, Malacarne ſhews that there is a ſinus, by no means uncommon, which belongs as ſtrictly as thoſe others to the petrous portion of the temporal bone.

He calls this new ſinus the anterior petrous ſinus ; and

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* This vein, the vena angolana, makes a very remarkable emiſſaria, but it is more probable that the blood in ſuch veins runs inwards than that it eſcapes from the ſcull to the external veins.—Cum venis poſterioribus frequentes nexus init.   Sommerring, vol. v. p. 354.

† The Emiſſaria, 4ta. of Tabarini. Obſerv. Anatom. p. 42, et. ſeq.

‡ In truth the ſuperior, and inferior, or oblique ſinus, the cavernous, and the tranſverſe, meet nearly at a point.

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the fuperior of other writers, he calls the pofterior pe-
trous finus; and the inferior petrous finus of other
writers, as it lies more upon the cuneiform apophyfis of
the occipital bone, and runs flantingly, he calls the ob-
lique. I would on the contrary confider two of thefe as
the petrous finufes; the oblique finufes of Malacarne, as
the lateral bafilar finufes; and thofe which run on the
middle of the cuneiform apophyfis, as the middle bafilar
finufes.

The ANTERIOR PETROUS SINUS runs upon the ante-
rior face of the petrous bone, from near the fpinal
hole *; whence, making a femicircular curve in the
angle of the petrous and fquamous portions of the tem-
poral bone, it terminates in the lateral finus.

The POSTERIOR PETROUS SINUS † lies in that pointed
extremity of the tentorium, which ftretches forward,
connected with the acute angle of the petrous bone. It
is narrow; and a fulcus or groove on the angle of the
bone gives a partial lodgement to it; it paffes from the
cavernous finus to the great lateral finus.

The LATERAL BASILAR SINUS ‡ is fhorter and larger
than the laft; and it makes an oblique curve from the
cavernous finus under the pointed extremity of the ten-
torium, which is continued by the fide of the fella tur-
cica, to the termination of the lateral finus, or rather
into the beginning of the jugular vein, by a channel,
feparated by a bony lamina from the termination of the
lateral finus; or it is continued into a vein in the bafe of
the cranium, which afterwards joins the great jugular
vein.

The MIDDLE BASILAR SINUS. This fcarcely deferves
the name of finus. It confifts, in general, of a few cel-
lular-like communications, formed in ftrong fibres of the
dura mater, which here partakes of the nature of a liga-

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* And here it has a tranfverfe branch of communication with the
cavernous finus, which runs under the extended point of the ten-
torium.

† Or fuperior petrous finus. Vicq d'Azyr.

‡ The inferior petrous, or oblique finus.

ment-

. ment. Thefe open into the laft-mentioned finus, or fometimes into the vertebral vein.

The VERTEBRAL SINUSES are veins included in the lamellæ of the dura mater ; and, divided into right and left ; they defcend into the tube of the vertebræ, on its fore-part, and pafs down even to the facrum. They are connected in all their length with the vertebral, dorfal, and lumbar veins. Thefe finufes, or veins, at each vertebra, are joined by a tranfverfe branch ; they are connected at the top of the fpine with the bafilar or anterior occipital finufes.

EMISSARIA SANTORINI. ·

" VENÆ EMISSARIÆ" is but another name for thofe leffer veins which form communications between the finufes within the head, and the external veins in the bafe of the cranium. Thefe, then, are chiefly the opthalmic *, maftoidean, and vertebral veins. But the vena fodalis arteriæ carotidis, the fmall vein which penetrates the parietal bone by the fide of the fagittal future, even the venæ arteriæ meningeæ fodales, and the little veins which pafs with fome of the nerves, or through the fiffures of the bone, are alfo brought into account. To thefe a much greater importance has been attached than they merit ; particularly in apoplectic affections of the head, they have been fuppofed to be eminently ufeful in emptying the furcharged finufes and veins of the brain into the external veins.

But thofe leffer paffages for the blood, fuppofing us to be affured that the blood flowed through them, from the finus to the external veins, are infignificant, when compared with the great out-let of the INTERNAL JU-

* " Je me fuis convaincu, par des diffections multipliées, que les
" finus caverneux & orbitaires communiquent, par un plus grand nom-
" bre de veinules, avec les arrières-narines, de forte que les hémorrha-
" ges critiques qui fe font par les nez, dans les fièvres aiguës, où la
" tète eft affectée, s'expliquent facilement par ce moyen," &c. Vicq
d'Azyr, Acad. Royale, 1781, p. 504.

Left Lateral Sinus

Longitudinal S.

Jugular Vein

Petrous S.

Great Longitudinal Sinus

Left Sinus

Straight Sinus

GULAR VEIN; to which we have feen all the finufes
tend. But the accumulation of blood in the veffels of
the brain is feldom mechanically produced ; it is a dif-
eafed action of the fyftem of the brain, to which we
become more and more liable as we advance in
years : and perhaps it is owing to the fame gradual
change which is operating on the venous fyftem from
infancy to old age.

The importance of the finufes in the circulation of
the blood in the brain, is either vaguely defcribed, or
imperfectly underftood by authors. We find it faid,
that the finufes fupport the blood againft compreffion,
and protect its free circulation. This to me feems an
erroneous idea. The leffer veins are, as in other parts
of the body, and have no fuch provifion ; and fince,
within the head, there can be no fuch partial compref-
fion as in the limbs, any caufe which would comprefs
the greater veins, were they not fupported, muft fall
upon their extremities with worfe effect. The circula-
tion is the only power which can act mechanically upon
the brain ; but this can never caufe a compreffion of its
veins, becaufe the increafed action of the arteries muft
tend more to the diftention of the veins than it will be
the occafion of the brain compreffing them.

The more general idea conceived of the ufe of the
finufes is nearer the truth ; viz. to prevent the fudden
and violent action of the mufcles of refpiration, or of
the mufcles of the head and neck, from injuring the
fmaller veins of the brain, by expelling the blood into
the internal jugular veins that the finufes prevent the
impulfe from being communicated to the blood in
the fmall and tender veins of the brain, which might
endanger a rupture of them *. Yet this is not ex-
actly the manner in which the finufes preferve the
leffer veins ; they do not fuffocate nor take off the
force of the impulfe from the regurgitating blood, fo
much as they would do if they were like the trunks of
veins in other parts ; becaufe, being incapable of diften-

* Monro, Nervous Syftem, p. 4.

D D 2

tion,

tion, they throw the undulation of the blood, when it is thus checked in its exit, backwards upon the extremities of the veins. But then the effect is, that no particular vein or trunk receives the shock; all suffer in a lesser degree, and equally, which is their safety. All the veins in the base of the brain, which would be liable to rupture, or diftention, from receiving, in their sudden turns, the shock of the blood, checked by the muscles of refpiration, or otherwise, are preferved by being inclosed in finufes, and covered by the strong lamellæ of the dura mater. The lesser veffels again are removed from the shock : its force is spent, becaufe it has spread among many branches; and it has become a general impulse upon the brain, which the brain refists, becaufe it is imcompreffible.

That the brain does receive such an impulse, in violent coughing and straining, is sufficiently evident from the rising of its surface on these occafions, when it is accidentally laid open by fracture, or the trepan *.

Although the obstruction of the jugular veins were to caufe no regurgitation of the blood ; although the finufes were suppofed to have an effect in preventing the distention of the veins, or return of the blood to the head ; still one effect of the continued action of the arteries is, to increafe the plethoric state of the brain, when there is a stagnation, or more or lefs remora, of the blood in the finufes ; and thence it is, that in every interruption to the free exit of the blood, the distention must ultimately fall upon the extreme veffels †.

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* The older phyficians, obferving the connection betwixt the motion of refpiration and of the brain, conceived that the air was drawn through the nofe and cribriform bone into the brain, fo as to diftend it. Upon this hypothefis followed many wonderful cafes.

We have already mentioned the hypothefis which fuppofed compreffion and relaxation of the cerebrum and cerebellum alternately, by the action of the falx and tentorium.

† We shall fay that thefe veffels cannot fuffer diftention, unlefs there be space given for their inordinate dilatation, by blood proportionally

We ought not to confound the idea of incompreffi-
bility of the brain with that of a folid fubftance, which
would allow no motion in the veffels within the cranium,
and would require us to invent fome fpecious means to
account for the circulation of the blood in the brain,
different from that of the other vifcera of the body.
Were the brain thus incompreffible, or rather folid, fo
as to prevent a free action of the veffels within the cra-
nium, then, as the blood enters with an evident pulfa-
tion, it muft neceffarily have returned by the veins with
a diftinct pulfation; but this pulfation is loft here, as in
the other veffels of the body, before it returns by the
finufes. When the blood is fent into the arteries of the
brain, by the ftroke of the heart, they dilate; and this
dilatation the pliability of the brain allows, by throwing
a comparative degree of preffure upon the veins. Again,
when the arteries (during the dilatation of the heart)
are in action, and contract, their blood enters the veins,
fo as to give to them a degree of dilatation equivalent to
their former compreffion, and which now gives the
freedom of contraction in return to the arteries; without
any compreffion, therefore, of the brain into a leffer
fpace, there is an activity allowed in the veffels.

This degree of motion, communicated through the
brain, is very fmall, nor does it affect the function of
the brain; as we fee, when the fcull is laid open, and
the pulfations of the arteries are, as it were, accumu-
lated, in their effect, to one point; for here the patient
does not fuffer, although the brain beats fo as to be fen-
fible to the eye. The circulation of the blood in the
brain may be obftructed, or it may be accelerated, until

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tionally fent out from the cranium. But there is a degree of
diftention upon them, a tenfion which cannot be relieved, nor
the contraction of the arteries allowed. The impulfe from the heart
and arteries is ftill continued, and is increafing the evil. Bleed-
ing here relieves this action, and diminifhes the danger; and by
this means we can fuit the activity of the veffels entering the brain,
to the temporary remora in thofe which convey the blood out of
the head.

this

this velocity affects the function * : or too much blood may be accumulated within the cranium ; but during this accumulation of the blood there muſt be a proportional ſpace, freed by the abſorption of the brain itſelf, or the partial accumulation in one part of the vaſcular ſyſtem of the brain muſt be accompanied by a deficiency in the other.

CHAP. III.

OF THE VENTRICLES AND INTERNAL PARTS OF THE BRAIN.

OF THE CAVITIES OF THE BRAIN IN GENERAL.

THERE are within the brain many tubercles and irregular ſurfaces, of which it is infinitely more difficult to convey an idea by deſcription than of the external parts. Theſe ſurfaces, as the name implies, lie in contact without adhering ; and form what we call, though not perhaps with ſtrict propriety, the cavities of the brain. Not being ſeparated, they are ſcarcely to be conſidered as cavities, although they be capable of diſtention by the infiltration of the fluid into them. The ſurface of the cavities or ventricles of the brain is naturally

* There is much found reaſoning and ingenuity waſted on the ſubject of the circulation of the brain: As the gentle murmuring of a ſtream, ſays Lower, lulls to repoſe, while the mind is diſturbed, or the imagination awakened by the din of a cataract ; ſo ſleep is induced by the gentle flow of the blood in the brain, or is diſturbed when the circulation is accelerated. As the fatigue and reſt of the body required a variation in the impetus of the blood towards it, the neceſſary conſequence was a variation in the degree of velocity in the circulation and quantity of blood in the head, and this to Lower is the reaſon of the viciſſitude of wakefulneſs and ſleep. The ſimple fact of the effect of preſſure upon the ſurface of the brain inducing an oppreſſion of the ſenſes has occaſioned all their theories of ſleep to turn upon this one idea of preſſure on the brain.

bedewed

bedewed with a fluid or halitus, which flows from the general furface of the ventricle, and from the plexus choroides. This moifture preferves thofe furfaces from adhefion ; during life and health it is not accumulated fo as to form a fluid ; but in many difeafes, and after death, it is effufed or collected into a fluid. The external convolutions of the brain we have feen to be cineritious on the furfaces : the internal furface of the brain may be confidered alfo as forming convolutions ; but they are chiefly medullary, and are more irregular, or rather have a greater variety of fhape, than thofe of the outer furface.

In regard to the ufe of the ventricles of the brain, fince the hypothefes of the older phyficians have been tacitly rejected, no opinion has been offered, except this, that " they feem to be made of a neceffary confe-
" quence, and towards the greater ufe and diftinction
" of parts ;" or, as we have already had occafion to mention, that the ventricles ferve to increafe the furface of the pia mater, and that whatever may be the purpofes which are ferved by that membrane on the furface of the brain, we muft fuppofe the fame to be performed by it within the ventricles. But this is a conclufion which may not be altogether fatisfactory to an inquifitive mind.

It is neceffary to take into confideration the general peculiarities of the brain : we find that within the fcull there is no adipofe fubftance, though it pervades every other part of the body. We at once fee a reafon for this. It is evident that as the fat is fo inceffantly undergoing changes (being alternately abforbed and depofited) ; as at one time it is depofited in greater quantities and at another abforbed ; as it is in perpetual variation according to the prevailing habits of the body, the proportion of exercife taken, or the ftate of the health ; its continual changes would have the very worft confequence upon fuch a part as the brain ; that if accumulated it would opprefs the circulating veffels ; if rapidly abforbed it would be followed by accumulation or furcharge of the veffels ; for the fcull does not allow of

• diftention,

diftention, nor is it poffible that the cavity of the cra-
nicum can admit of depletion.

I conceive the ventricles to be a provifion for allowing
thofe changes to take place, which neceffarily, from
time to time, arife, or are occafioned by difeafe in the
fubftance of the brain itfelf: they prevent an inftanta-
neous bad effect.   When fluids diftend the ventricles, it
fometimes occurs to us that the fluid, fecreted and ac-
cumulated, muft have compreffed the fubftance of the
brain, and caufed its abforption; but I conceive that
frequently the caufe is reverfed; the abforption of the
mafs of the brain being the difeafe or its confequence,
and the fluid being poured out in the ventricles to fupply
this deficiency: I alfo conceive that the collected fluid
being in the central parts, is a particular provifion by
which the whole mafs of the brain is kept uniformly
diftended; whereas, if the furface had been equally, or
more difpofed to fuch fecretion of fluid, the internal
parts would have fallen flaccid, and been compreffed
rather than fupported.

There cannot be a more erroneous notion than that
in hydrocephalus the compreffion produced by the fe-
creted fluid occafions the wafting of the brain.   In that
difeafe the fubftance of the brain is not firm and com-
preffed, fo as to prevent the veins from being com-
pletely filled; but, even in a very early ftage, the mafs
of the brain is foft and fluid; the veins peculiarly dif-
tended or enlarged; and from the firft or inflammatory
ftage of the acute hydrocephalus, to its termination,
the difeafe is not a dropfy of the ventricles, but a
univerfal affection of the brain.   The effect of the
difeafe is, that there is a change in the relative powers
which inceffantly fecrete and abforb the brain itfelf,
as every other part of the body is fecreted and abforb-
ed.   And in confequence of this there is a dimi-
nution of the folids of the brain, and an accumulation
of the fluids to fupply their lofs.

It is not to be fuppofed that the ancients, fo fertile
in their hypothefes, and fo eafy in their proofs, could
neglect the evident importance of the ventricles of the
                                                    brain.

brain. We accordingly find that the fpirits were manufactured in thefe cavities; that they were the " fpirituum animalium officina," whence the fpirits were conveyed over all the nervous fyftem *. They were again degraded from this higher office, and became the mere receptacles of the excrementitious matter of the brain (meras cloacas effe afferuerint †); and Willis feems inclined ftill further to degrade the importance of the ventricles, by confidering them merely as of fecondary importance; or rather as refulting folely from the accidental conformation of the brain ‡. Again, we find it a prevalent opinion that the ventricles contained air; that the air fupported the foft medullary fubftance of the brain; and that it gave motion to the whole mafs, fo as to circulate the fpirits in the fubftance of the brain §.

OF THE CORPUS CALLOSUM AND CENTRUM OVALE OF VIEUSSENS.

THE CORPUS CALLOSUM is a medullary body which is a centre of communication; or it is the great commiffure ‖ paffing betwixt the hemifpheres of the cerebrum ** : it is feen without incifion by merely feparating
thofe

* Lately, by chemical aids, (which makes the cineritious fubftance black, or dark brown, while the medullary matter remains white, or takes a flight greenifh tinge,) the origins of many of the nerves have been traced into the fubftance of the brain, even to the furface of the ventricles, which has given occafion to the revival of fimilar ideas of the ufe of the ventricles.

† Willis Cereb. Anat. p. 32.

‡ " Porro fi quis cerebelli fabricam exacto confiderat, et ferio per-
" pendit, quod hi ventriculi non ex primaria naturæ intentione effor-
" mentur, at fecundario tantum et accidentaliter de cerebri compli-
" catione refultent," &c.

§ Malpighi.

‖ Commiffure is a term applied to thofe tracts generally of medullary matter, which paffing through the brain are fuppofed to be a medium of communication.

** Willis conceiving the fpirits to lodge and circulate in the fuperficial convolutions of the brain, (upon the conformation of which depended the capacity or ability,) gives to the corpus callofum the property of collecting and concentrating the fpirits, " quafi in *publico*
emporio

thofe hemifpheres with the fingers. It is a white body, firmer than the reft of the medullary fubftance. It is but flightly convex upon its upper part, but turns convex downwards upon the fore and back part. As the corpus callofum is the continuation of the internal medullary fubftance of the brain, it is fuperfluous to fay that it is continued down, anteriorly, into the medullary matter betwixt the corpora ftriata, terminating in its pedunculi ; or, backwards, that it is continued with the fornix and cornua ammonis and the furface of the pofterior prolongation of the lateral ventricle.

We fee upon the furface of the corpus callofum two medullary lines confiderably raifed, running parallel to each other * in the length of the body. Betwixt thefe falient lines there is of courfe a kind of rut, called fometimes the rapha, or future, which may be confidered as dividing this body into two equal parts, and which, in truth, forms the accurate divifion of the two fides of the whole brain †.

Other lines, lefs elevated from the furface, are to be obferved running acrofs thefe, as if paffing from one hemifphere to the other. If the corpus callofum be cut horizontally, and the fection be continued into the fubftance of the hemifpheres, we ftill can perceive thofe

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emporio commorantur ;" and here they were depurated by repeated circulation.—But the language in which all this is delivered, better veils the abfurdities of the doctrine : " fpiritus recens nati unde- " quaque ab extima hujus corporis ora verfus anteriorem iftius cor- " poris callofi partem, ubi craffimum exiftit, perpetim blande fca- " tent ; ibidemque, fi opus fuerit, aut imaginationis actui impen- " duntur, aut medullæ oblongatæ crura fubeuntes, appendicem ner- " vofam actuant et infpirant." What remains fuperfluous of the fpirits returns backwards and circulates through the fornix, and is ftill farther fubtilized, " hoc motu fubtiliores quofdam phantafiæ actus " peragunt."

* They are not ftrictly parallel in all their length ; we find them often feparated both upon the fore and back part ; but generally more feparated upon the back part, and even fometimes they are curved.

† In which conceit Duverney calls this " clef du cerveau," from its being the centre of communication. Tom. i. p. 39.

tranfverfe

tranfverfe lines, and obferve them to be loft in the me-
dullary matter of the hemifpheres *.

The ·Centrum ovale is merely the appearance
which the white and internal part of the cerebrum takes
when the brain is cut horizontally on the level of the
corpus callofum; for then the corpus callofum is the
centre of the great medullary mafs of the cerebrum, and
the cineritious matter being on the external edges only,
forms the central white mafs into an irregular oval.

THE SEPTUM LUCIDUM.

The two lateral ventricles lie under the corpus callo-
fum and medullary centre, they are divided by a partition,
which defcends from the lower furface of the corpus callo-
fum, and refts upon the fornix. This feptum of the ven-
tricles is tranfparent, and confifts of two lamina, and thefe
confift of medullary and cineritious matter †. Betwixt
thefe lamina is the cavity of the feptum lucidum ‡. The
fize and fhape of this cavity differs in a variety of fub-
jects. It is of a triangular fhape, and from eighteen to
twenty lines in length §. It has a fluid exhaling into
it like the ventricles, and is by fome counted as a fifth
ventricle: according to Santorini it opens in the bafe
of the brain, oppofite to the union of the optic nerves.
Vieuffens defcribes it communicating with the third ven-
tricle ||. Winflow alfo has feen it reaching a great way
backwards, and conceives it to open into the third ven-

* The neceffity of explaining paralyfis and convulfive motions of
that fide of the body oppofite to the fide of the brain injured, have
made anatomifts attend to thofe tranfverfe lines, in the hopes of find-
ing fuch a decuffation of thefe lines as would account for it. Sab-
batier fays, they have brought themfelves to believe that there was
a decuffation, but after careful inveftigation he could find no fuch
thing. See Winflow. Ludwig (de Cinerea Cerebri, fub. p. 5.)
obferved ftriæ of cineritious fubftance in the corpus callofum. See
alfo Gunz. and Haller.

† Vicq d'Azyr.

‡ It was difcovered by Silvius. See alfo Santorini.
§ Sabbatier.

|| " In qua pellucidum non raro reperimus aquamque haud dubie
" in tertium illabitum ventriculum." Vieuffens de Cerebro, p. 59.

                                                    tricle.

tricle. Soemmerring defcribes it as large in the middle, contracted backwards, and having no communication; but he afferts that it is fhut in on every fide *. In the bafe of the brain we find a narrow longitudinal fulcus betwixt the pedunculi of the corpus callofum. In the bottom of this cavity there is a medullary lamina, which Vicq d'Azyr calls " *Cloifon à la cavite du feptum lucidum.*" And the fulcus he calls " *Foffe de la bafe du* SEPTUM LUCIDUM." By a careful fection of this medullary fubftance we lay open the cavity of the feptum lucidum.

The Anterior Curvature
of the   Fornix

The Pedun   cles of
the   Fornix

Optic   Nerves

Corpora Albicantia

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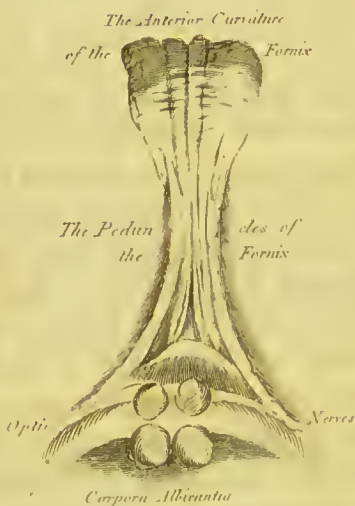
* De Corporis Humani Fabrica, tom. iv. p. 55.

LATERAL VENTRICLES.

UNDER the corpus callofum and medullary centre, are the lateral ventricles. They are diftinguifhed into right and left. They are of a very irregular fhape, ftretching into three prolongations or cornua, whence they have the name of tricornes. They are the great ventricles of the brain ; the third and fourth being comparatively very fmall. What may be confidered as the bodies of thefe ventricles are formed betwixt the corpus callofum and medulla of the brain, and the convexity of the corpora ftriata and thalami nervorum opticorum. Following the cavity forwards, we find what is called its ANTERIOR HORN or finus, formed betwixt the more acute convexity of the corpus ftriatum and the anterior part of the corpus callofum ; into the pofterior lobe of the cerebrum, refting upon the tentorium, there ftretches backwards with fome confiderable curve, and, at the fame time, with a flight inclination downwards, the POSTERIOR HORN.

Again, the INFERIOR or DESCENDING HORN is like the continued cavity of the ventricle ; it takes a curve backwards and outwards, and then turning forwards it defcends into the middle lobe of the brain.

The lateral ventricles do not terminate in the others by any of thofe prolongations ; but they communicate, upon a very high level, with the third ventricle and with each other, by a wide opening, formed under the forepart of the arch of the fornix. This communication we eafily find by following the choroid plexus forward and under the fornix : it is a fpace betwixt the moft anterior part of the convexity of the optic thalami and the anterior crura of the fornix.

OF THE PARTS SEEN IN THE LATERAL VENTRICLES.

THE FORNIX is a medullary body, flat, and of a triangular fhape : its lower furface is towards the third ventricle :

ventricle : its lateral margins are in the lateral ventricle. On its upper furface it fupports the feptum lucidum, or partition of the two lateral ventricles, and under its moft anterior part is the communication betwixt the lateral ventricles and the third ventricle *.   One of the angles is forward, and the other two towards the back part : it refts chiefly upon the thalami nervorum opticorum, but it is feparated from them by a vafcular membrane, which is continued from the external pia mater, and which ftretches into the brain betwixt the pofterior part of the corpus callofum and tubercula quadrigemina, and which membrane connects the plexus of the lateral ventricle.   The fornix leaves betwixt it and the convex faces of the anterior parts of the corpora ftriata, a triangular fpace, which is in part occupied by the feptum lucidum.

The extremities of this body are called crura.   The pofterior crura coalefcing with the corpus callofum, (which is continued downwards pofteriorly,) are prolonged into the hippocampi, and the anterior crura forming the anterior angle being clofe together, bend downwards behind the anterior commiffure, and are connected with it : they then bend round the thalami, and may be traced into the crura cerebri ; or, according to others, they form the corpora albicantia †.   Thofe pillars or crura of the fornix are fibrous in fome flight degree like a nerve.   This is to be obferved by cutting them either acrofs or in their length ‡.

Upon the lower furface of the fornix there are lines like thofe of the corpus callofum, and which are erroneoufly conceived by many to be the impreffion of the veffels of the velum.   It is this lower furface of the

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* Of this communication fee farther in the Anatomy of the Brain illuftrated by engravings.

† Two white bodies feen on the bafe of the brain behind the infundibulum.

‡ Vicq d'Azyr, Acad. Scien. 1781. p. 517.

fornix

fornix which is called LYRA, CORPUS PSALLOIDES, it
being compared to a ftringed inftrument *.

OF THE HIPPOCAMPI, OR CORNUA AMMONIS, AND
OF THE TENIA HIPPOCAMPI.

Plan of the Connections
of the Fornix with the Hippocamp! &c.

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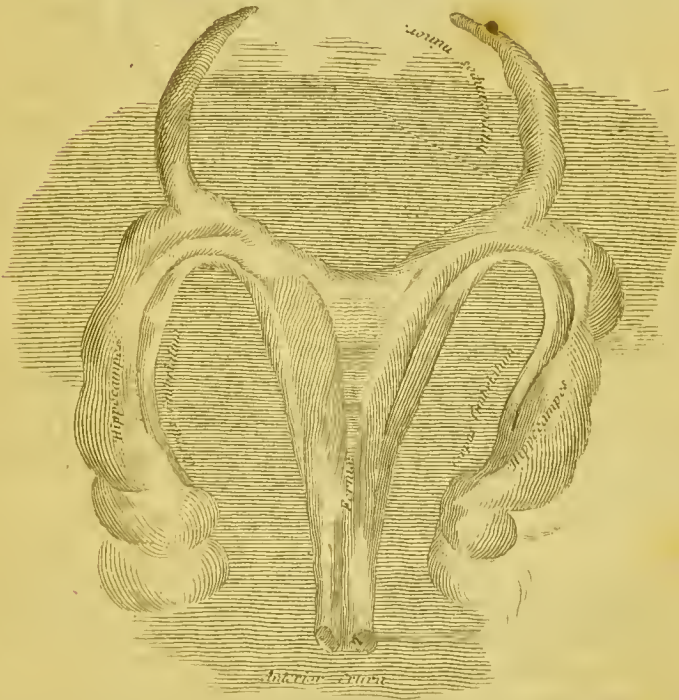
* The prevalent idea amongft the older authors regarding the ufe
of the fornix was, that it acted like a ligament binding together the
internal parts of the brain ; or that it fupported the incumbent weight
of the upper parts of the brain from preffing upon the lower.   " Ve-
" rum alter atque ifte infignior fornicis ufus effe videtur quem modo
" inuimus ; nempe ut fpiritus animales per ejus ductum ab altera
" cerebri extremitate ad alteram immediate tranfeant, atque ita
" quafi per pelicani roftrum in fui ipfius ventrem intortum circulen-
" tur.'' Willis.

THOSE

THOSE parts are to be feen continued from the pofte-rior crura of the fornix. We have obferved, that upon the back part, the fornix adheres to, or is continuous with, the corpus callofum. We fhall find alfo that its pofterior crus on each fide divides into two lamina of medullary matter: the one of thefe is continued into the cornu ammonis, and the other (being the anterior of thefe portions) forms the tenia hippocampi.

The hippocampos is narrow at its commencement in the pofterior crus of the fornix * ; but it is enlarged as it defcends, following the courfe of the inferior pro-longation of the lateral ventricle towards the bafe of the brain. It is, indeed, merely a relief or particular con-vexity of the floor of this lower horn of the ventricle, like a pad. The inferior extremities of the hippocampi on each fide turn inwards, pointing to the crura cerebri, and taking thus a curve like a ram's horn †. In its whole extent the hippocampos confifts of an internal ci-neritious fubftance, and a fuperficial layer of white me-dullary matter ‡.

The TENIA HIPPOCAMPI, or CORPUS FIMBRIATUM, is the prolonged margin of the fornix: it is merely the thin edge of the hippocampos, which follows in the whole of its circuit, and terminates in an acute point near its bulbous extremity.

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* In fpeaking of the origin of the hippocampos as from the fornix, I mean fimply that the ftudent having gained the knowledge of one part of the brain may trace the others from their relation to it, and that, underftanding the fituation and relation of the fornix, he traces its crura until he finds them terminating in the hippocampos. We might fully as well fay that the hippocampi are formed from the pofterior part of the corpus callofum, for they are the fame medullary matter continued.

† Betwixt the extreme point of the hippocampi and the crura cerebri (when the bafe of the brain is turned up) we can infinuate the probe into the inferior horn of the lateral ventricle without pier-cing the fubftance of the brain, but merely tearing the pia mater.

‡ " Vers la partie inferieure et pofterieure du corps calleux, on " trouve, de chaque côté, un petit bourrelet de fubftance grife qui " fe prolonge dans l'epaiffeur de l'hypocampe dont il fait partie : ce " bourrelet eft recuvert dans fon principe par une lame de fubftance " blanche." Vicq d'Azyr, loc. cit.

The

The LESSER HIPPOCAMPOS, or COLLICULUS, is a re-lief or convexity in the floor of the posterior horn of the ventricles, which may be traced backwards from the crura of the fornix. It has the same relation to the fornix which the greater hippocampos has, and lies in the posterior horn or prolongation of the ventricle into the posterior lobe of the brain, in the same way in which the great hippocampos lies in the inferior horn or pro-longation of the ventricle into the middle lobe of the brain.

The velum and plexus require to be taken away be-fore we can fully understand the situation of the third ventricle, or of those tubercles which are but partially seen in the lateral ventricles.

The VELUM lies in the centre of the brain, and ex-tends from the surface of the brain inwards betwixt the posterior lobes of the cerebrum and the cerebellum, then betwixt the corpus callosum and nates and testes, and then under the fornix. It forms thus a great communi-cation betwixt the external and internal membranes of the brain. As it lies under the fornix, that medullary lamina adheres to it, while the velum again adheres to the thalami nervorum opticorum. Its margin seems to to be terminated laterally by the choroid plexus (when we view it after raising the fornix) ; but it is not strictly so, for the choroid plexus is continued with the mem-brane of the ventricles, and has no where a termination. For the vascularity of this membrane, turn to what has already been said in speaking of the internal veins of the brain.

Seeing how the plexus choroides are formed and con-nected, they cannot be strictly said to have either begin-ning or termination ; they are the connected folds and plicae of the internal membrane of the ventricles loaded with vessels ; but to describe them intelligibly we must, notwithstanding, trace them in this manner. The PLEXUS of the LATERAL VENTRICLES rise from the bottom of the inferior horns of these ventricles betwixt the pedunculi or crura cerebri and the termination of the hippocampi ; they lie like fleshy bodies in that lower

horn.   As they rife into the fuperior level, they are at their greateft fize (there they have often a difeafed appearance, being hard, and as if fchirrous or full of little veficles or hydatids) ; they then pafs forwards and inwards, diminifhing in thicknefs until they coalefce under the fornix, and immediately behind the communication betwixt the ventricles.   The PLEXUS OF THE THIRD ventricle, formed by the union of thofe of the lateral ventricles, turns back upon the lower furface of the velum, and is comparatively very fmall.

The CORPORA STRIATA are fmooth, cineritious convexities in the fore-part of the lateral ventricle.   They are fomewhat of the fhape of a pear ; they are obtufe forwards ; they approach each other towards the fore-part with a regular convexity, and they are narrow as they pafs backwards, feparating at the fame time ; their pofterior extremity being as it were pufhed out by the thalami nervorum opticorum.   Thefe laft lie more under the back part of the fornix, and are more concealed when the lateral ventricle only is laid open.   The corpora ftriata, are fo called from the inter-mixture of the medullary matter in their fubftance, which gives the appearance of ftriæ when they are cut. They defcend down to the bafe, and give origin to the firft pair, or olfactory nerves *. The ftriæ of medullary matter pafs from above downwards, they therefore appear in the horizontal fections of this body like white points.   A fuperficial horizontal fection of the corpora ftriata fhews thofe ftriæ connected with the medullary matter of the middle and pofterior lobe.   A deeper incifion brings into view a mafs of cineritious fubftance betwixt thofe ftriæ and the medullary matter of the middle lobe.   Another incifion fhews the courfe of the ftriæ altered, and brings into view the connection betwixt the corpora ftriata of each fide, by means of the anterior commiffure †.

The

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* Soemmerring.
† " *Hæc pars commune fenforium eft,* quod fenfibilium omninm " ictus a nervis cujufque organi dilatos accipit adeoque *omnis fenfionis* " *perceptionem afficit ;* cujufmodi fenfibilium ictus, cum hinc ulterius " in

The COMMISSURA ANTERIOR is a cylindrical medullary cord, which unites the fore and lower part of the corpora ftriata, and which fpreads its connections for a full inch and a half into the middle lobe of the brain upon each fide. We fee it ftretched tranfverfely immediately under the anterior crura of the fornix. It is in figure like a bow; its extremities ftretching (with a convexity forward) into the middle portion of the brain towards the extremity of the foffa filvii, where it terminates in the medullary matter of the middle lobe of the brain.

The THALAMI NERVORUM OPTICORUM are hid by the pofterior angles of the fornix, and the plexus choroides : we do not fee them fully until we have lifted the fornix and the velum or membrane which ftretches under the fornix. They are fomewhat of an irregular oval fhape; they are whiter than the corpora ftriata, their furface being chiefly of medullary matter. Internally they are cineritious ; and the medullary and cineritious matter is blended in ftriæ like the anterior tubercles of the ventricles or corpora ftriata.

The thalami nervorum opticorum, having their convex furface towards each other, unite under the fornix by what is called the COMMISSURA MOLLIS, in oppofition to the commiffura magna, which is the corpus callofum ; the commiffura anterior, which unites the fore-part of the corpora ftriata ; and the commiffura pofterior, which is yet to be defcribed.

This foft commiffure of the brain, or the union of the optic thalami, is fo foft that the flighteft force will tear it, or in diffection, the parts being unequally fupported, the thalami will be feparated and this connection loft *. After fuch feparation of the tubercles there

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" in cerebrum trajiciuntur, *fenfioni* ftatim imaginatio fuccedit ; atque " infuper hæc corpora, uti fenfuum omnium impetus, ita motuum " localium fpontaneorum primos inftinctus fufcipiunt." Willis, Edit. 4. p. 43.

* Morgagñi and Vicq d'Azyr fay they have feen this commiffure double.

remains

remains very little appearance of their having been united. Sabbatier, after the moſt careful diſſection, ſays expreſsly that he could never obſerve this union, and he conceives, that in the ſmoothneſs of the contiguous ſurfaces he has a proof of there never being ſuch a union ; but he goes on to ſay, " The fruits of my " reſearch were, that I conſtantly found a ſoft cord of " a cineritious colour, and about a line or a line and a " half in diameter paſſing betwixt them."

I have ſeen, when the ventricles were diſtended in hydrocephalus, and the communication betwixt the three ventricles enlarged to a ſquare cavity of nearly an inch in diameter *, that this union was drawn out to ſome length, but ſtill was above half an inch in diameter. The commiſſura mollis is exceedingly ſoft, of a cineritious colour, and veſſels are ſometimes ſeen to croſs upon its ſurface. It ſeems to be the continuation of the grey or cineritious ſubſtance which covers the internal ſurface of the optic thalami †.

Towards the fore-part of the thalami we have to obſerve a peculiar eminence or convexity, viz. the ANTERIOR TUBERCLES of the optic thalami. In making a horizontal ſection of the thalami, we find that we cut acroſs a medullary ſtreak or cord which deſcends from this tubercle to the mamillary proceſſes, or corpora albicantia, in the baſe of the brain ‡. Its courſe is deep in the ſubſtance of the brain, and ſomewhat oblique. The limits of the thalami externally are contiguous to the corpus ſtriatum, but betwixt them there intervenes a white medullary tract, which is continuous with the medullary ſtriæ, and which, as it marks the limits of the two great tubercles of the lateral ventricles, takes a courſe inwards towards the anterior pillars or crura of the fornix and middle of the anterior commiſſure. The

* In quadrupeds the adheſion is more extenſive.
† Mais il n'y a point de continuité, proprement dite, entre la ſubſtance intime de ces couches et la commiſſure molle dont il s'agit. Vicq. d'Azyr, Planc. de Cerv. p. 23.
‡ See Vicq. d'Azyr, plate xii. Mem. de l'Acad. Royale, 1781, p. 528, and plate 2, fig. 5.

ſurface

furface of this tract, as feen in the lateral ventricle, is the TENIA SEMICIRCULARIS GEMINUM, which we fhall prefently more particularly defcribe.

To underftand the further connections and importance of the optic thalami we muft diffect the bafe of the brain. There we find that it is through the corpora ftriata, and the thalami nervorum opticorum, that the crura cerebri eftablifh their extenfive connection with the internal mafs of the brain ; particularly we find that the crura fhoot up into the back and lower part of the thalami.

Here on the lower part alfo we may obferve the TRACTUS OPTICUS, which we may trace backwards from the optic nerves. They furround the crura cerebri with a femi-circular fweep, fwelling out at the fame time, and terminating in three confiderable tube-rofities : they are finally confounded with the lower part of the optic thalami * ; at the fame time there runs up a divifion of it into the nates.

The TENIA SEMICIRCULARIS GEMINUM is the tract of the medullary matter, which is betwixt the two great anterior tubercles of the lateral ventricle, the corpus ftriatum and thalamus nervi optici. Towards the fore-part of this tract its furface is covered with a layer of a femi-tranfparent greyifh matter, through which we fee the veins which pafs from the furface of the corpora ftriata to join the vena Galeni †. Sabbatier makes the anterior extremity of this medullary body join the anterior pillar of the fornix : Haller makes it join the anterior commiffure : and Vicq d'Azyr fays they feparate

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* Willis feeing the firft and fecond pair of nerves fo clofely con-nected with thefe tubercles, and fuppofing, as we have mentioned in a former note, that the corpora ftriata were the common fenfo-rium, concludes, " hinc ratio patet, cur odores fine olfactus objecta " ipfum adeo cerebrum feriunt, et immediatè afficiunt ; item cur " inter vifionem et imaginationem communicatio citiffima habetur." P. 44.

† " Quelquefois il fe detache du tænia femicularis entre le " corps ftrie et la couche optique un filet blanc, que faiffant un angle " très aigu, foit en devant, foit en arrière, monte à une certaine " hauteur fur le corps cannele." Vicq d'Azyr, Mem. de l'Acad. Royale, 1781, p. 530.

E E 3

again,

again, where they feem to unite forwards and lofe themfelves on the corpora ftriata. Their pofterior extremities are loft in the hippocampi; they thus form a kind of longitudinal commiffure which eftablifhes a communication betwixt the fore and back part of the cerebrum.

OF THE THIRD VENTRICLE.

THE third ventricle does not at all anfwer to the conception we form of the ventricles from the lateral ones. It is a mere fulcus, lying betwixt the thalami nervorum opticorum, and betwixt the crura cerebri, which are continued down from thefe tubercles. It is a longitudinal flit, rima, or gutter-like cavity, which is made irregular, and is divided by the union of the optic thalami; and finally, it is canopied by the fornix and vafcular velum which ftretches over the thalami *.

Plan of the communication
of the Lateral & 3ᵈ Ventricles
Reprefented by a perpendicular Section.

A A *The Lateral Ventricles.*
B *The Fornix.*
C *The Choroid Plexus of the lateral Ventricles.*
D *The Union of the Plexus.*
E *The Communication betwixt the lateral Ventricles and at the same time with yᵉ 3ᵈ Vᵗ.*
F *The 3ᵈ Ventricle.*
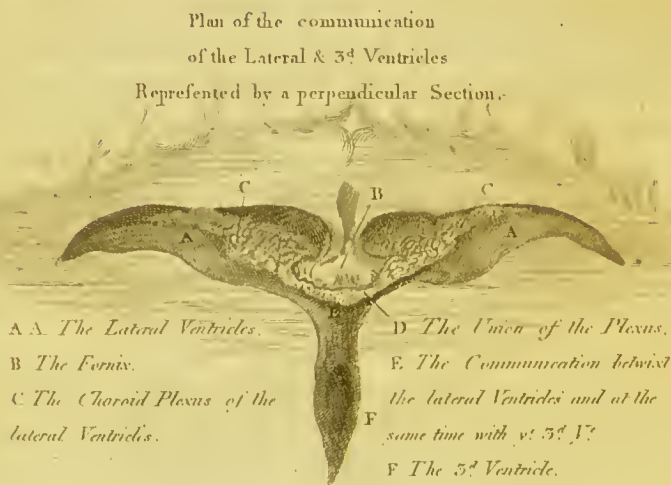
* " Hanc caveam ventriculum tertium vulgo vocant, quæ et ipfa cum plena fint omnia ,nihil eft nifi contiguorum thalamorum limes." Haller.

THE

THE third ventricle opens forward and upwards into the two lateral ventricles, and under the common communication it opens into the infundibulum. Backwards it is continued by a canal which paffes under the tubercula quadrigemina, or nates and teftes, into the fourth ventricle. The bottom of the third ventricle is clofed by a fmall ftratum of cineritious matter, *cloifon pulpeufe du troifieme ventricule*; this fills up the fpace betwixt the junction of the optic nerves and the anterior commiffure. We fee it when diffecting the bafe of the brain. Lifting the optic nerves, we fhall find it ftrengthened by the pia mater, and confifting of ftriæ which pafs obliquely backwards and downwards, and fome of which, while they adhere to the optic nerves, pafs into them.

As we have found that the pia mater could be traced into the lateral ventricles, and as by tearing with the probe the connections of thofe membranes we could penetrate into the lateral ventricle without piercing the fubftance of the brain; fo here we can penetrate into the third ventricle, which is deepeft of all; and alfo into the fourth, without lacerating the fubftance of the brain. Thus, after raifing the vafcular membrane of the bafe, we can pafs a probe under the corpus callofum backwards into the third ventricle, and by raifing the cerebellum from the medulla oblongata, and feparating the adhefions of the pia mater, we get accefs to the fourth ventricle. We conclude then, that the ventricles are not formed, as we fhould at firft conceive, in the fubftance of the brain, but that they are formed by the replication and foldings of the convolutions of the brain.

Plan of the Inflections of the Pia Mater.

See foot Note.

OF THE INFUNDIBULUM.

As I have explained in my tables of the brain, there is much confusion regarding the terms vulva and anus. Vulva is the space by which the three ventricles communicate, as seen when the fornix is lifted, viz. betwixt

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EXPLANATION OF THE PLATE.

1. The pia mater defcending betwixt the hemifpheres to the corpus callofum.
2. Betwixt the pofterior lobe of the cerebrum and the cerebellum.
3. Under the fornix in form of the velum.
4. Into the inferior horn of the lateral ventricle.
5. Into the bottom of the fourth ventricle.

the

the thalami nervorum opticorum and before the commif-
fura mollis. The anus is behind this commiffure, and
near the nates and teftes; both thefe are mentioned as
communications betwixt the ventricles: but we know that
the union of the plexus choroides, of the two lateral
ventricles, and of the termination of the velum under
the anterior part of the fornix, leaves the vulva free. But
the velum fpreading over the thalami, and under the pof-
terior part of the fornix, clofes up the anus; and it ap-
pears as a communication fimilar to the other only when
the velum is torn up.

If we pafs a probe gently downwards and forwards
from the vulva or foramen commune anterius, or com-
munication betwixt the ventricles, we pafs it into the
infundibulum. The INFUNDIBULUM is a funnel of a
foft cineritious matter, which leads from the bottom and
fore-part of the third ventricle towards the glandula pitu-
itaria, which is feated in the fella turcica of the fphenoid
bone.

The infundibulum is formed of cineritious matter,
which is continued from the bottom of the third ventri-
cle, and which adheres to the back part of the optic
nerves; or, according to Warthon, of an external
membrane with cineritious matter internally. Its cavity
becomes contracted before it reaches the glandula pitui-
taria. Whether it be really capable of conveying the
fluids of the ventricles, or whether it be actually pervi-
ous, is likely to remain a difputed point. Tarin, and
M. Adolphus Murray, and Haller, believe with the
older writers that it is pervious. Sommerring and Vicq
d'Azyr have in their experiments found it fhut *. But
to the opinion that the infundibulum conveyed the fuper-
fluous moifture from the ventricles †, it did not feem
neceffary to Vieuffens that we fhould find it to have a
cavity

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* " Sed non ad apicem ufque pervium." Soemmerring.
† " Structura, fituque infundibuli fpectatis, connexionis, & fo-
" cietatis, quam cum cerebro, et glandula pituitaria habet, rationi-
" bus æquo judicio perpenfis, unicum illius ufum effe, ut aquofum,
" feu

cavity in all its length. He conceived that where the apparent cavity terminated, lefs vifible pores were continued towards the gland.

" feu lymphaticum quemdaèm cerebro depluèntem humorem, majoris,
" ad inftar vafis lymphatici excipiat et pituitariam verfus glandulam
" fenfim tranfmittat, non autumare non poffumus : Etenim eum inter
" textarum plexibus choroidæis glandularum ufus fit, ut fanguinis
" calvariam fubeuntis, fpiritufque animalis materiam fuppeditantis,
" aquofiorem partem, definentibus in ipfas ab arteriis depofitum ex
" cipiant, quæ deinceps per infenfiles rariffimæ, qua obducuntur,
" membranæ poros, fenfim transfluit, et partim per vulvam partimve
" per anum, in tertium cerebri ventriculum delabitur ; nullus effe
" videtur ambigendi locus, quin aquofus omnis humore glandulis, quæ
" plexuum choroidæorum vafis interferuntur, fenfim affluens, ad in
" fundibulum deferatur." Vieuffens, p. 50. Such was the opinion
regarding the œconomy of the brain, and now we have no theory,
good or bad, nor any explanation of this connection of the gland
with the ventricles of the brain to offer.

INFUNDIBULUM AND PITUITARY GLAND.

Gland and Infundibulum
taken out.

Pituitary Gland Seated
in the Sella Turcica.

Sinus

gland

Caroted Art?

Infundibulum
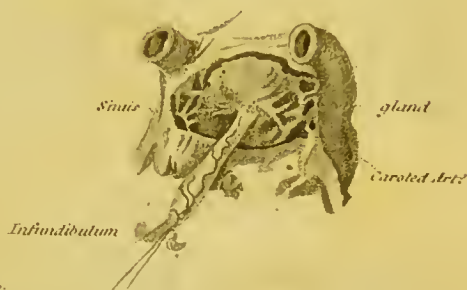
What is called the PITUITARY GLAND is a reddiſh
body of a glandular-like ſtructure *, which is ſeated in
the ſella turcica of the ſphenoid bone. It is plain upon
its upper ſurface, or rather perhaps a little hollowed, of
a globular ſhape below, and having a diviſion into two
lobes. The infundibulum terminates in it, piercing the
dura mater, a thin lamina of which ſpreads over the
gland. The gland, as is ſeen in the above plate, lies
ſurrounded with the circular ſinus, and has the caver-
nous ſinus upon the ſides; into theſe laſt, veſſels have
been ſeen to paſs from the gland †, which, as Soemmer-
ring obſerves, were probably veins. A diſtinction of
ſubſtance has been obſerved in this gland, and it is by
ſome conſidered as a part of the brain, or being like
the cineritious ſubſtance, it has been ſuppoſed that it
gave nerves to the fifth or ſixth pair.

It was conceived that the body receiving the ſuperflu-

* It perhaps has only the form of a gland. Haller ſays " non
" acinoſa quidam, neque nullius alterius glandulæ ſimiles, quæ po-
" tius cerebri quedam ſit appendix." See alſo Bordeu, Recherch.
Anatomiq. ſur les Glands. Pituet Glandulæ Vitium, Sandiſt. Theſ.
Vol. III.

† Adolph. Murray de Iɴfundib.

ous

ous moifture of the brain, conveyed it into the nofe ; or into the neighbouring finufes *. To countenance this opinion, there was no want of cafes proving the accumulation of the fluids of the ventricles, in confequence of the fchirrus of this gland †, while in truth diffection has fhewn no connection betwixt the difeafes of the ventricles and pituitary gland. M. Littre gave both a vafcular ftructure and mufcular fibres to this body, and conceived that its operations brought down the water and air from the ventricles of the brain ‡.

THE TUBERCULA QUADRIGEMINA.

THE tubercula quadrigemina, or nates and teftes, are feen when we continue to lift back the pofterior part of the fornix and corpus callofum, and when we have lifted back the velum with the vena Galeni. We find, in doing this, that the velum is connected with the pineal gland, which is feated upon thefe tubercles. The tubercula quadrigemina are not in the cavities or ventricles of the brain, but are feen upon lifting and turning forward the pofterior lobes of the cerebrum from the cerebellum.

Thefe four tubercles are behind the third ventricle, and above the fourth. As they are immediately in the centre of the brain, they form a kind of commiffure, and they both communicate with the tubercles, from which the tractus opticus emerge. The uppermoft two are the NATES, the lower are the TESTES ; the former are lefs white than the latter. A little under the inferior tubercle, we find fometimes a fmall tract of medullary matter, which extends to the thalami nervorum optico-

* Lower, Tract. de Corde.
† Schneider (de Catarch.) firft oppofed this theory ; fhewed that there was no communication betwixt the brain and the nofe, and maintained that no fluid, not even the blood which flowed from the nofe, had any connection with the brain : he was fupported by other able anatomifts. The old opinion was revived by M. *Bouillet, Elémens de Medecine pratique.*
‡ See Littre, Mem. de l'Acad. des Sciences, 1707.

rum,

rum, and the crura cerebri. And from the lower part
of the teftes there project backwards, connecting itfelf
with the crura cerebelli, a thin medullary lamina, which
is the VALVULA VIEUSSENII, PROCESSUS a CEREBELLO
AD TESTES, or VELUM INTERJECTUM. Behind the
pofterior tubercle, or from this medullary lamina itfelf,
the fourth pair of nerves take their origin. Sometimes
thofe four tubercles are of the fame fize ; fometimes the
pofterior, fometimes the anterior tubercles, are the lar-
ger : a perpendicular fection of them fhews a mutual
communication of ftriæ of medullary and cineritious
matter, but thofe are only feen faintly.

THE PINEAL GLAND.

rum, and the crura cerebri.

Third Ventricle — *Peduncle of the P.G.* — *Pofterior Commiffure* — *Pineal Gland* — *Tubercula Quadrigemina*

THE pineal gland is feated above the tubercula qua-
drigemina, and behind the thalami nervorum opticorum ;
it is fixed, fays Winflow, like a button. It confifts of
cineritious matter covered with the pia matter ; its
bafe is furrounded with medullary matter ; it ad-
heres firmly to the velum, and is apt to be difplaced or
torn from its pedunculi in lifting that membrane. It is
a fmall foft greyifh body, irregularly round, or of the
figure of a pine apple ; or, of all things, likeft the heart
of

of a frog *. Its pedunculi, or footstalks, pass out from a transverse medullary base, which unites it to the posterior commissure. Those pedunculi pass on each side to the thalami nervorum opticorum (leaving a passage under and betwixt them to the fourth ventricle). Their extremities pass forward upon the internal surface of the thalami nervorum opticorum, and are united to the anterior crura of the fornix.

Vicq d'Azyr remarks, that although the ideas of Galen and Descartes †, and a crowd of others are remembered only with ridicule, there are still some peculiarities in the situations and connection of this body, which mark its importance. It is composed of cineritious substance; it is in fact a prolongation of the substance of the brain, and by its pedunculi, which are like two nerves, it is connected with the thalami nervorum opticorum, with the fornix, and consequently with the -corpus callosum, the hyppocampus and corpora albicantia, which are themselves the centre of union to several medullary cords; therefore he concludes that the pineal gland must be an important organ ‡.

The pineal gland has often in it little peculiar grains and calculi §. It has a great variety of form and size;
I have

* Ruysch considered the substance of this gland as different from that of the cerebrum or cerebellum, and different, also, from all other glands.

† Alluding to their opinion of this being the seat of the soul; Willis imposed upon this part a lower office, "Ejusque munus non "aliud omnino esse quam aliarum glandularum quæ juxta vasorum "sanguiferorum concursus disponuntur; nempe ut humores serofos, "a sanguine arteriofo depositos, excipiat, et in se retineat; donec "aut venæ depletiores factæ eosdem reforbeant, aut lymphæ ductus "(si qui adfuerint) eos extra convehant." Willis, p. 46.

‡ Mem. de l'Acad. Royal, An. 1781, p. 533. See Observ. par M. Mechel sur la Gland pineal, sur la cloison transparente, et sur l'origine du nerf de la septieme paire. L'Acad. Berlin, 1765.

§ " La parte anteriore della base n'è ordinariamente midollare, "e qui appunto l' ho moltissime volte veduta gessata, ossosa, tarta-"rofa e friabile, vizi, che ho trovati anche molte volte nei picciuoli." Malacarne, part ii. p. 81. Acervulus: Meckel, Mem. de l'Acad. des Sciences a Berlin, 1755, fig. 1. b. b. Vicq d'Azyr, tab. xxvii. " Super medullofum conarii vinculum vel in ipso vinculo, vel in ipso " denique

I have found it furrounded with pus in an ideot-boy, who was accuftomed to wander about the Leith glafs-houfes. He died with fymptoms of hydrocephalus, and in his ventricles, accordingly, there was found much fluid. Malacarne gives a cafe of its having degenerated into hydatids, like a clufter of grapes ; I have alfo feen this appearance. It has not been found upon diffection· in fome cafes.

POSTERIOR COMMISSURE.

THE bafe of the pineal gland is connected with the pofterior commiffure of the brain. This commiffure is feen like a cord, or like the anterior commiffure, to-wards the back part of the third ventricle, before the tubercula quadrigemina, and above the iter ad quartum ventriculum. Betwixt this commiffure and the bafe of the pineal gland, we have to obferve two or three me-dullary filaments, not paffing from the gland, but lying parallel to the commiffure. But this part of the brain, which appears like a cord, does not deferve the name of commiffure ; it does not pafs on each fide into the fub-ftance of the brain as the anterior one does ; it is loft in the neighbouring border of medullary matter, and is merely this matter reflected, fo as to have a rounded edge.

CEREBELLUM.

THE cerebellum lies under the pofterior part of the ce-rebrum. It weighs about a fixth or feventh part lefs than the cerebrum ; it lodges in that part of the bafe of the cranium which belongs to the occipital bone, and has the tentorium ftretched over it : and it is divided into two great lateral portions by the fpine of the os occipitis and the falx cerebelli.

" denique acervulo, plerumque vero ante acervulum iam in fetibus
" inmaturis peculiares quidam lapilli, mox maiorum acervulum, mox
" vero duo vel tres minores acervulos conftituentes, helui, femiperlu-
" cidi, iunioribus femper pallidiores, annofioribus fufciores, infauti-
" bus ob coloris languorem et perluciditatem difficiles cognitu ficcati
" albidiores et opaciores inveniuntur." Soemmerring, p. 63.

The

The cineritious matter of the cerebellum is external, like that of the great mafs of the cerebrum ; but the medullary internal matter prefents an appearance fomewhat different, for on a fection being made it appears branching like a tree, and has been called *arbor vitæ*.

The concentration of the medullary matter, from the two fides of the cerebellum, towards the nodus cerebri, form what are called the crura cerebelli.

OF THE FOURTH VENTRICLE.

THE fourth ventricle defcends perpendicularly before the cerebellum ; it is inclofed above by the valvula cerebri, below by the medulla fpinalis, and on the right and left by the crura cerebelli.

When, from the third ventricle, we pafs our probe obliquely backwards and downwards under the pofterior commiffure, it paffes into the ITER AD QUARTUM VENTRICULUM, or AQUEDUCT of SILVIUS. This paffage to the fourth ventricle, goes before the tubercula quadrigemina. The VALVULA VIEUSSENII, it was fuppofed, prevented the falling down of the moifture of the other cavities into the fourth ventricle * : it is more properly called the PROCESSUS CEREBELLI AD TESTES, being a medullary lamina fpread over the ventricle and betwixt the crura cerebelli, as they rife from the ARBOR VITÆ, or the internal medullary part of the cerebellum.

From the aqueduct there is continued down upon the fore-part of the fourth ventricle a kind of fiffure; which Vefalius, conceiving it to have fome refemblance to a writing quill, called CALAMUS SCRIPTORIUS. The fame fiffure or furrow is continued down fome way upon the fpinal marrow.

There pafs up obliquely outwards, on each fide of the calamus fcriptorius, medullary lines, three or four in number, but fometimes feven are obferved †. One of thefe fibres afcends to the valvula Vieuffenii; fome

* Alveus Silvii.
† Haller, Phyfiol. tom. iv. p. 78.

are the origines of the auditory nerve, and one or two ftriæ go to form part of the eighth.

In the fourth ventricle, as in the others, are fome convolutions of the plexus choroides; thefe are on each fide at the termination of the vermis; they are continued out upon the bafe of the brain, and are feen expofed betwixt the feventh and eighth pair of nerves.

OF THE BASE OF THE BRAIN AND ORIGIN OF THE NERVES.

Relation of the Brain & Scullcap.
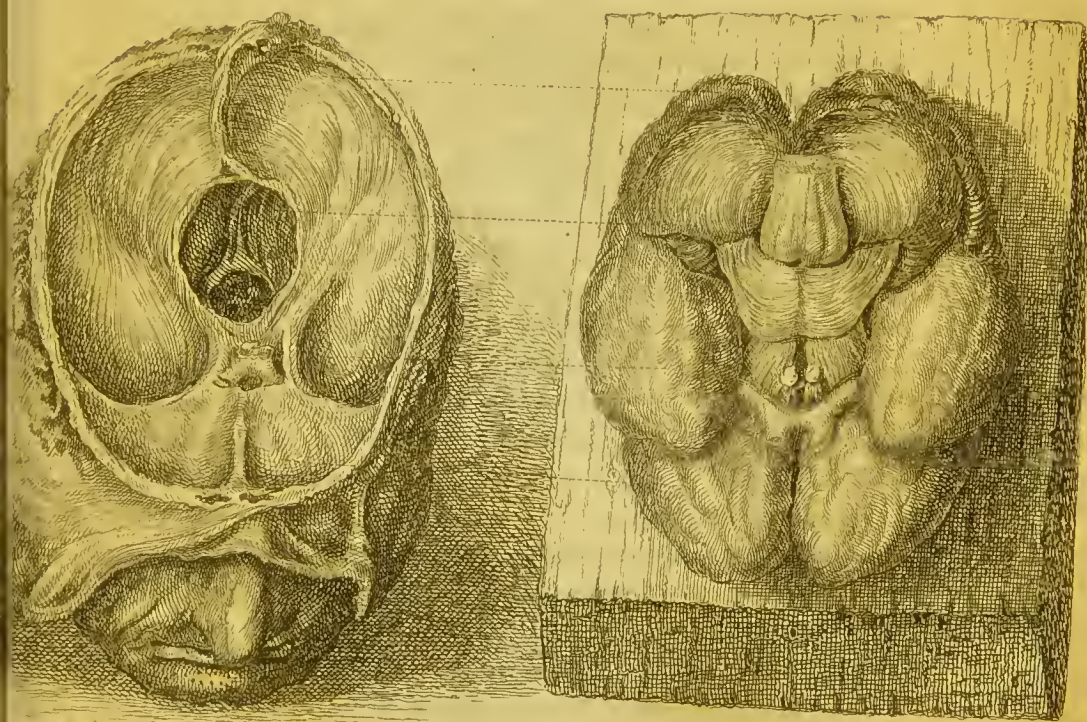
WE have anticipated much that might have fallen to be treated of in this divifion of our fubject; but my intention here is to give a connected view of the parts, as feen when we have raifed the brain from the fcull, and when, having the bafe prefented to us, we are about to enumerate the origins of the nerves.

The firft appearance which ftrikes us is the great proportion of the medullary matter in the bafe of the brain; the whole furface of the brain, while feen from above,

was cineritious, but now the centrical medullary part of the brain is feen emerging from the envelopement of the cineritious matter, and, gathering together from the feveral internal medullary proceffes of the brain, it concentrates the effential properties of the encephalon, and is fitted to give out the feveral nerves. Thofe great medullary prolongations of the cerebrum and cerebellum are called the crura.

The CRURA CEREBRI are compofed of a white fibrous medullary matter, in which alfo there is a mixture of cineritious fubftance. They are formed from the whole central medullary part of the cerebrum; or more immediately from the inferior and lateral part of the corpora ftriata, and from the fuperior and internal part of the thalami nervorum opticorum; and, from the conflux of medullary matter, from the anterior and pofterior lobes of the cerebrum. From all thefe various parts the medullary matter, paffing downwards and backwards, forms the crura *. The crus of either fide of the brain, contracting their diameters, unite at an acute angle, and are united to the pons Varolii, or nodus cerebri, formed by the crura cerebelli; they pafs on to form the medulla oblongata, and, as they unite with it, they raife it into the eminences, called Corpora Pyramidalia. In thofe proceffes of the cerebrum, the cineritious and medullary fubftances mingle with fome degree of confufion; fo that when we make a fection of the crura cerebri near to their union with the pons varolii, we obferve a fubftance of a dark-brown colour, furrounded with white or medullary matter. In the angle of the union of thefe crura cerebri, behind the corpora albicantia, and before the protuberance of the pons varolii, we obferve a matter lefs perfectly white than the furrounding medullary fubftance, which forms a floor to the third ventricle. This part is perforated with a great many holes, and is the *fubftance perforée* of Vicq d'Azyr †, and gives origin
to

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* I fpeak ftill of the relation of thofe to each other, according to their natural fituation in the fcull.

† Vicq d'Azyr makes three divifions of this *fubftance perforée*—
1ft. At the roots of the tubercles, from whence the firft pair of
nerves

to the third pair of nerves along with the crura them-selves.

CRURA CEREBELLI.

THE crura cerebelli are more expofed than thofe of the cerebrum; the latter lying deeper, and being com-paratively fmaller. They are formed by the union of the internal medullary part of the cerebellum, or the arbor vitæ. They are altogether compofed of medullary mat-ter, except near the pons varolii, where we obferve a mixture of coloured ftriæ.

PONS VAROLII.

THE PONS VAROLII, TUBER ANNULARE, or NODUS CEREBRI is formed by the union of the crura cerebri and cerebelli; thofe names are almoft defcriptive of its fhape and relation to the other parts. Varolius, looking upon thofe parts inverted, compares the crura cerebri to a river paffing under a bridge, and thence named it Pons. The nodus cerebri, again, is a name well applied, fince this medullary eminence has much the appearance of a knot caft upon the medullary proceffes of the cere-brum, and is in fact the central union of the elon-gated medullary matter of both cerebrum and cerebel-lum.

On the furface of this medullary protuberance there are many tranfverfe fibres, which, uniting in a middle line, form a kind of rapha, which, upon a fuperficial fection, fhews a longitudinal medullary line. The fibres upon the furface of this body are uniform and parallel to each other in the moft projecting part; but upon the fides, they difperfe to give place to the fifth pair of nerves and crura cerebelli.

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nerves emerge betwixt the roots of thofe nerves, and near the origin of the optic nerves. 2d. Thofe I mention betwixt the crura cerebri. 3d. On the outer contour of the optic thalami.

A deeper

A deeper incifion of the pons varolii, while it fhew the intimate union of the crura cerebri, cerebelli, and pons varolii, alfo fhews the white medullary tracts which extend from the crura cerebri through the pons varolii to the corpora pyramidalia; part of thefe pafs through the LOCUS NIGER CRURUM CEREBRI, and can be traced to the corpora ftriata. We fee alfo the tranf-verfe fibres of the medullary and cineritious fubftance, which make a right angle with thofe longitudinal tracts.

Anatomifts have fought to explain a very curious phe-nomenon by fuppofing that there is a decuffation of the nervous filaments at this part. It has often happened that an injury to the one fide of the brain, an ulcer or tumor on one fide, caufed a lofs of power in the oppofite fide of the body *, and the lateft authority we have † proves that a tumor on the one fide of the pons varolii, will produce an effect on the other fide of the body. But no decuffation can be obferved; fibres, as I have faid, run acrofs like commiffures, but the tract of matter is direct not oblique.

I am tempted to think there muft remain much ob-fcurity on this fubject of the decuffation of the fibres of the brain, or origin of nerves. I have found that the effect is not conftant. An ulcer in the hemifphere of the cerebrum produced weaknefs in the fame fide; and in one well marked cafe of hydrocephalus, when the brain on diffection was equally affected on both fides, the one fide of the body was convulfed and drawn up, and the other fide motionlefs. This is not a fingular occurrence; I have feen the eyes, face and tongue in perpetual motion; but the force entirely on one fide; both lateral ventricles were full of water.

* The obfervation has defcended from *Hippocrates*, and the expla-nation that it depends on a decuffation of the roots of the nerves is from *Aretæus*.
† Medico-Chirur. Tranfactions, VII.

MEDULLA OBLONGATA.

Section of

the

Pons

Varolii

Medulla

Oblongata

1 Corp.ª Pyramid.ª

2 corp.ª Olivaria
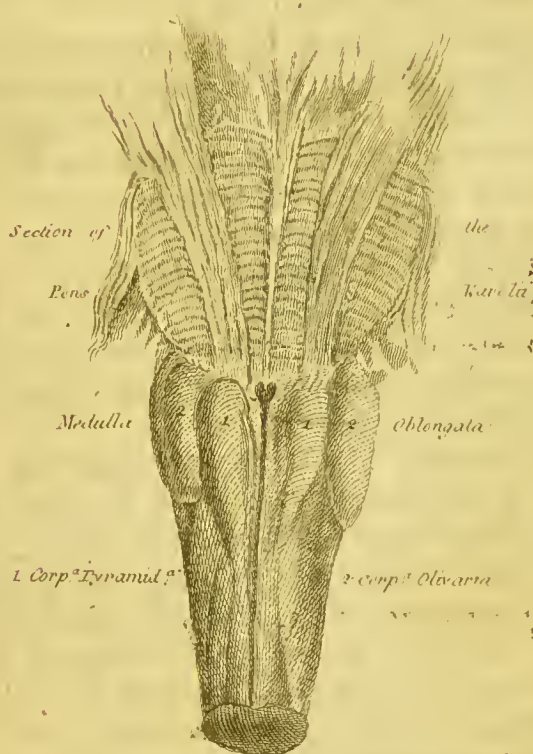
THE medulla oblongata is the prolongation of the fub-
ftance of the crura cerebri and cerebelli, and the pons
varolii; it is confequently the continuation of the ence-
phalon, which, after giving off the nerves that pafs
through the foramina of the fcull, enters the canal of
the fpine to fupply the fpinal nerves. The medulla ob-
longata is marked at its upper end by a deep fulcus divid-

ing

ing it from the pons varolii; but towards the fpinal ca-
vity it decreafes in thicknefs, and there is no natural dif-
tinction or fulcus to mark the point where the medulla
oblongata ends, and the medulla fpinalis begins; nor
perhaps is the medulla oblongata to be confidered in any
other light than as the beginning of the fpinal marrow.
When it paffes the foramen magnum, it ceafes to be
called the medulla oblongata.

We have to obferve four eminences upon the me-
dulla oblongata, viz. two corpora pyramidalia, and two
corpora olivaria. The CORPORA PYRAMIDALIA, fo
called from their fhape, are thofe in the middle. There
is formed betwixt them and the pons varolii (being three
tubercles placed together) a little fulcus, which fome
have called the FORAMEN CÆCUM. Betwixt thefe
eminences there is a longitudinal fiffure, in the bottom of
which there may be obferved tranfverfe little cords,
which are like commiffures connecting the two fides of
the medulla oblongata.

The CORPORA OLIVARIA lie upon the fides of the
corpora pyramidalia. They are in fome degree, like
them, limited by the fulcus which bounds the pons va-
rolii, rounded above and bulging, but gradually fubfid-
ing, at their lower part, into the level of the medulla
fpinalis; yet they are internally different, for anatomifts
had obferved a mixture of a yellow or cineritious-co-
loured matter in the corpora olivaria, but Vicq d'Azyr
has obferved a regular oval medullary fubftance, or body
furrounded with cineritious-coloured fubftance, like a
miniature-reprefentation of the cerebrum itfelf; he calls
it CORPUS DENTATUM EMINENTIÆ OLIVARIS.

MEDULLA SPINALIS.

THE medulla fpinalis, from its ftructure, its two fub-
ftances, its membranes, and its ufe, as evident in the
confequences of injury, muft be confidered as an elonga-
tion of the brain. Its name implies its fituation con-
tained within the tube of the fpine. Though chiefly
compofed of medullary matter, it is not entirely fo; for
there is an irregular, central, cortical fubftance, through

its

its whole extent, having fomething of a crucial form in the fection of this part *. There are continued down from the calamus fcriptorius behind, and the rima, formed by the corpora pyramidalia, before, two fiffures which divide the fpinal marrow into lateral portions. On the back part, however, the fiffure is very little diftinguifhable. Into the anterior one the little veffels penetrate to fupply the cineritious matter with blood. The two lateral portions are divided into an anterior and pofterior portion, fo that this prolongation has four diftinct portions. The fpinal marrow diminifhes in thicknefs as it defcends in the neck; but below the giving off of the brachial plexus it again enlarges, then continues gradually to diminifh.

The tube of the vertebræ is connected by a ftrong ligamentous fheath, which runs down the whole length within the tube. The dura mater, after lining the internal furface of the cranium, goes out by the great foramen, and forms a kind of funnel; at the occipital foramen it is united firmly to the ligament. Further down, however, it forms a feparate tube. The tunica arachnoides again adheres loofely, having a kind of fecretion within it, while the pia mater clofely embraces, and is intimately united to the medullary matter.

From betwixt the ninth nerve and vertebral artery to the fecond and third lumbar nerve, there is a membranous connection betwixt the lateral part of the fpinal marrow and the dura mater of the fpine. From the manner of its connection to the dura mater, by diftinct flips irregular and pointed, it is called the Ligamentum Denticulatum, or Dentatum.

SCHEME AND GENERAL DESCRIPTION OF THE ORIGINS OF THE NERVES OF THE ENCEPHALON AND SPINE.

In enumerating the nerves which pafs from the cranium, I fhall keep to the old way of Willis, counting

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* The furface of the fpinal marrow has alfo been obferved to be of a darker colour, and in large animals diftinctly cineritious. (Dr. Monro's Nervous Syftem.)

only

only nine nerves of the encephalon. I do not find that the fub-divifions of the nerves in this claffification, and the defcription of the feveral fafciculi, of which the pairs of nerves are compofed, caufe intricacy. It rather, I am from experience convinced, connects fome circum-ftances with many of the pairs of nerves thus enume-rated, to which the memory of the ftudent can attach. The common enumeration feems a natural one; it ferves well the purpofe of diffection, and confequently will never be entirely exploded. The ufe of new claffifi-cations and arrangements, and names, whilft we muft alfo retain the old, adds much to the intricacy of de-monftration.

From the olfactory nerve to that which paffes out betwixt the cranium and firft vertebra, there are nine nerves *,

1ft pair—Olfactory nerves.	*Caruncula mamillares Math.* de Grad, *Proceffus ad nares.* Gonth. d'An-dernac. 8ᵘᵐ par Spigel. 1ft pair of Willis.
2d pair—Optic nerves.	*Nervus vifivus, feu viforius.* Carpi, 1ⁿ *par antiquorum.* 2d pair of Willis.
3d pair—Motores oculorum.	2ᵘᵐ par Fallop. et Vefal. Nerfs moteurs communs des yeux.—Winflow. 3d pair of Willis.
4th pair—Trochlearis.	*Minor propago* 3ⁱⁱ *Paris, id eft* 5ⁱ *recentiorum,* Fallop. *Gracilior radix* 3ⁱⁱ *Paris, id eft* 5ⁱ *recentiorum.* Vefal. *Nervus qui prope nates oritur.* Euftach. 9ᵘᵐ par Cortes: et Columb. 4th pair; or, pathetic nerves of Willis.
5th pair—Trigemini.	*Nervous anonymus trigeminus multorum.* 3ᵘᵐ par Fallop. et Vefal. 5th pair of Willis. Trijumeaux of Winflow.

* In the following table I am indebted to the fynonymie of Vicq d'Azyr.

6th

6th pair—Abductores.		4^{um} par Fallop. *Radix gracilior* 5^i *Paris, id est* 7^i *recentiorum Vesal.* *Par oculis prospiciens.* 8^{um} par Capp. Bauhini. 6th pair of Willis. Nerfs oculo-musculaires, ou moteurs externes de Winflow.
7th pair	Auditory nerves.	2^{um} par Alexand. Benedict. 4^{um} par Carol. Stephan. 5^{um} par Vesal. et aliorum. 6^{um} par V. Horne. Portia mollis, of the Moderns.
	Nervus communicans faciei.	*Distinctus a molli nervus.* Fallop. *Portio ut præcedens* 5^i *Paris, id est* 7^i *recentiorum.* Vesal. Portio dura, of the Moderns. Le petit sympathique, of Winflow. Facial nerve.
8th pair	Glosso-pharyngeus.	*Qui ad musculos linguæ et faucium tendet. Fallop.* Le rameau lingual de la 8^e paire of Winflow. 8th pair d'Anderfch. Superior fasciculus of the 8th pair of Willis. *Glosso Pharyngeus.* Haller.
	Par vagum.	*Nervus sextus* Galeni *et aliorum.* 5^a *conjugatio* Carol. Stephan. 7^{um} par Alex. Benedict. 6^{um} par Casp. Bauhini. 9^{um} par Bidloo et Anderfch. 8th pair of Willis. Le moyen sympathique of Winflow.
	Spinal accessory nerve.	The spinal nerve.
9th pair—Lingual.		7^{um} par Fallop. Vesal *et aliorum.* 11^{um} par Bidloo. 10^{um} par Anderfch. *Par linguale medium, vel nervus lingualis medius.*—Haller. Soemmerring *et aliorum.* The hypoglossal, *sub-lingual,* or guftatory. The 9th pair of Willis.
10th pair—Sub-occipital nerve.		10th pair of Willis. 1ft spinal, or cervical nerve, of Haller. I count this the firft cervical nerve.

FIRST PAIR; OR, OLFACTORY NERVES [*].

THE olfactory nerve is soft and pulpy, and soon re-
folved by putrefaction; therefore, we fhould not be fur-
prifed that it was neglected by the ancients [†]. It ad-
heres firmly to the lower furface of the anterior lobe of
the brain, but it does not take its origin here. It is of
a triangular fhape, as if moulded to the fulcus in which
it lies; by being fometimes funk into the fulcus more or
lefs on one fide than the other, it has the appearance of
being larger on one fide than the other. It takes its
origin by three medullary tracts [‡]; 1ft, From the cor-
pus ftriatum; 2d, From the medullary matter of the
anterior lobe; 3d, From the fore and under part of the
corpus callofum [§]. When a fection is made of it, we
obferve in it a cineritious portion.

Towards the fore-part, this nerve expands into a bul-
bous oval lobe, which confifts of a femi-tranfparent ci-
neritious fubftance. This lies upon the cribriform
plate, and from it are fent down the nerves which ex-

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[*] In the prefent enumeration and defcription of the nerves, we
attend chiefly to their relation to the brain. In the introduction to
the next part of this volume, they will be found arranged and claffed
previous to the detail of their minute diftribution.

[†] The olfactory nerve is in brutes a large prolongation of the fub-
ftance of the brain, and is the proper mamillary proceffes. Their
olfactory nerves have a cavity or ventricle in them, and it was natural
for the ancients to imagine that the pituita of the brain was from this
ftrained through the cribriform plate into the nofe. Vefalius proved
the abfurdity of this opinion; it was, however, revived by Dulau-
rens, who was perhaps more of a courtier than an anatomift. But
Willis is not much better, when he defcribes the proper ufe of thefe
nerves. He fuppofed the cribiform plate of the æthmoid bone to
prevent bodies from paffing up into the brain (" ne quid afperi aut
" molefti cum illis una ad cerebrum feratur"); while the lymph in
thofe nerves corrected the too pungent odours; " odorum fpecies
" demulcere, eafque fenforio quadantenus præparare."

[‡] Or we fay that the external root generally fplits, having two
fafciculi. See Prochafka, tab. 1. Scarpa, Annot. Anat. p. 106.

[§] Vicq d'Azyr, M. de l'Acad. Roy. 1781.—" Breviores fibræ
" medulloræ cum longioribus exterioribus connexæ nonnunquam
" cineream particulam excipiunt." Soemmerring.

pand

pand upon the membrane of the nofe, and compofe the organ of fmelling *.

SECOND PAIR; OR, OPTIC NERVES †.

THE optic nerves arife from the pofterior part of the optic thalami, whilft they have a connection with the tubercula quadrigemina. When we trace the optic nerves backwards into the tractus opticus, we find them taking a circle round the crura cerebri, then enlarging, each forms a tubercle towards the back part of the thalamus opticus, and afterwards unites with the pofterior tubercle of the thalamus opticus; at the fame time a divifion ftretches towards the teftes, while betwixt the pofterior tubercle of the thalamus opticus and the nates, there is an intermediate communication. When thofe tubercles are fairly expofed by feparating the middle lobes of the brain, and diffecting away the tunica arachnoides and pia mater, they are feen fmooth, and formed of medullary matter; which is uniformly continued from the one to the other, following their gentle convexities with an uninterrupted furface. Within thofe tubercles is a mixture of cineritious and medullary matter, and, efpecially, there is a diftinct ftreak which paffes from the tractus opticus to the nates ‡.

Thus there is a communication betwixt the nates and teftes, and the optic nerve; but we muft ftill confider the nerve as arifing in a peculiar manner from the thalamus opticus, while at the fame time it adheres to the crus cerebri.

Tracing the optic nerves from their origin in the brain towards their exit from the fcull, we find them

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* Duverney has fhewn us, that thofe nerves paffing through the cribriform plate become firm nerves, like thofe in the other parts of the body. They are to be feen by tearing the membrane of the nofe from the bone.

† The optic nerves were the firft pair of Galen and many of the older anatomifts, they being ignorant of the olfactory nerves.

‡ Santorini tab.   Scarpa Anatom. Annotat. p. 106.

approaching

approaching gradually and uniting juſt before the cor-
pora albicantia and the infundibulum.·

Section of the Union of the Optic Nerve.
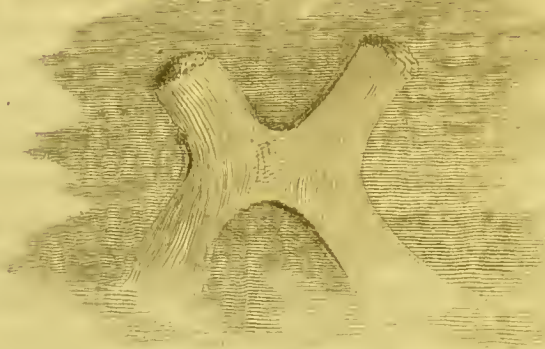
Since the days of Galen, it has been a diſputed point,
whether there is a union ſimply of the nerves, or a de-
cuſſation. Fiſhes have the nerve ariſing from one ſide
of the brain paſſing to the eye of the other ſide: they
croſs, but they do not unite. Birds have but one optic
nerve ariſing from the brain, which ſplits and forms the
right and left optic nerves. Veſalius diſſected a young
man at Padua, who had loſt his eye a year before; at
the ſame time he diſſected a woman, whoſe eye had
been loſt a long while. In the latter he found the nerve
of that ſide ſmaller, firmer, and of reddiſh colour,
through all its extent. In the young man he obſerved
no effect upon the nerve. He alſo gives a plate of an
inſtance in which he found the optic nerves paſs on to
the eyes of the ſame ſide from which they take their
origin, without adhering at all.

Valverda, a phyſician of Spain, who travelled into
Italy, and ſtudied the works of Veſalius and Human
Diſſection, ſays, that at Venice he had frequent oppor-
tunities of aſſuring himſelf that there was no decuſſation;
for

for robbers were punifhed for the firft offence by lofing one of their eyes; and for the fecond by death. Riolinus, Rolefinkius, and Santorini, give obfervations of the nerve of the injured eye being fmall and fhrivelled, and of their having traced them paft their union to the fame fide of the brain with the eye to which they belonged. Vicq d'Azyr, who, of all authors I conceive to be the beft authority upon fuch fubjects, is decidedly of opinion that there is no decuffation. Zin alfo agrees with the opinion of Galen, that there is an adhefion and intimate union of fubftance, but no croffing of the nerves. Soemmerring deems it fufficient to point out the authorities on both fides of the queftion, while he has no decided opinion whether there be a perfect decuffation or not *. Porterfield, while he allows the intimate union of the optic nerves, has feveral obfervations, proving that they have no interfection or decuffation.

Sabatier, encouraged by the authority of Morgagni, fays, that he could trace the affection of the nerve of the injured eye no farther than to the union. He difcredits the accounts of their having been traced to the fame fide of the brain, and believes the affertions to be the confequence of previous opinion and prejudice.—— There are certain obfervations of Valfalva, Chefelden, and Petit, which feem to prove, that where the brain is injured, it is the eye of the oppofite fide that is affected †. After their union the optic nerves are much contracted in diameter; ftill the optic nerve is the largeft of the head, excepting the fifth pair. It is the firmeft of all the nerves of the fenfes, but fofter than the other nerves ‡.

What remains to be faid of the optic nerves, falls

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* " Ergo, utrum omnes nervorum fibræ, an qædam tantum mutuo " fe fecent, certe ftatui nequit."

† If Petit and others are proving that the optic nerves are affected in the fide oppofite to the injury of the brain, they are proving that they have no decuffation; for if they had, it would counteract that effect, which, from the ftructure of the brain, they muft have in common with the other nerves.

‡ Soemmerring.

more

more naturally to be treated of when fpeaking of the organ of vifion.

THIRD PAIR OF NERVES; MOTORES OCULORUM.

THE third pair of nerves arife from the internal margin of the crura cerebri, and the perforated medullary matter which is betwixt the crura. The delicate filaments of this nerve cannot be traced far into the fubftance of the brain, but ftill we may obferve them fpreading their filaments, and traverfing the dark-coloured fpot which we have already mentioned to be vifible in the crura cerebri. Some anatomifts have faid, that the third pair of nerves had an origin alfo from the nates and teftes. Ridley defcribes them as rifing from the pons varolii *.

In relation to the arteries, thofe nerves are betwixt the pofterior artery of the cerebrum, arifing from the divifion of the bafilar artery and the anterior artery of the cerebellum †. They diverge from each other as they proceed forwards, and each penetrates under the anterior point of the tentorium by the fide of the cavernous finus, and paffes through the foramen lacerum. In the general defcription it is fufficient to fay, that they are diftributed in common to all the mufcles of the eye.

THE FOURTH PAIR OF NERVES.

THE fourth pair of nerves, pathetici, or trochleares, are the fmalleft nerves of the encephalon, being not much larger than a fewing thread. This nerve comes out from betwixt the cerebrum and cerebellum, paffes by the fide of the pons varolii, and after a long courfe

* They feem to come from the angle betwixt the crura cerebri and pons varolii. They are flat near their origin, but become round and firm.

† " Cette difpofition peut expliquer pourquoi on éprouve tant de " péfanteur aux yeux aux approches du fommeil, dans l'ivreffe & " dans certains efpeces de fievre." Sabatier. This is a mechanical and a moft improbable way of accounting for fuch an effect.

I

pierces

pierces the dura mater behind the clynoid procefs, runs along for fome way in a canal or fheath, formed by the dura mater; it then paffes through the cavernous finus, continues its courfe onwards through the foramen lacerum to the orbit, and is finally appropriated to the fuperior oblique mufcle of the eye.

The origin of the fourth pair, if we take implicitly the defcriptions of authors, feems to have a much greater variety than any of the other nerves; fo that it is common to fay, the fourth pair of nerves arife about the region of the nates and teftes *. The trochlearis arifes fometimes by two filaments, but more commonly by one undivided root †. This root is feen to emerge from a point betwixt the medullary lamina of the cerebellum, or valvula Vieuffenii, and the lower part of the tubercula quadrigemina ‡.

From the connections of the parts whence this nerve arifes with the reft of the brain, it is prefumed, that this fourth pair of nerves has a very immediate and univerfal connection with the internal parts of the brain; yet there is nothing in the final diftribution of the nerve, which fhould incline us to believe that there fhould be any particular provifion in its origins.

* " " " Pone corpora bigemina pofteriora mox paullo fuperius, " mox paullo iaferius, mox magis exteriora, mox magis interiora " verfus radice fimplici, duplici, triplici, quin et quadruplici oritur. " —Nonnunquam origo ejus in cerebri valvula, nonnunquam in ipfo " frenulo patet ut humore ventriculi quarti alluatur." Soemmerring, vol. iv. p. 209.

† Santorini fays, they have three roots or little fafciculi. Wrifberg following Vieuffens, fays, the fourth pair arifes from the valvula cerebri. Vicq d'Azyr. See Haller, faf. vii. tab. 3. " Origo " alius fimplex eft, alius duplex; quando fimplex eft, a proceffu a " cerebello ad teftes exterius prodit, quam eft tranfverfa ftria, quæ " eos proceffus conjungit." Haller Phyf. vol. iv. p. 208.

‡ " Et fouvent ils fe confondent avec un tractus medullaire placé " tranfverfalement au-deffus de la valvule du cerveau." Vicq d'Azyr. This nerve, fays he, cannot be followed into the anterior part of the brain from its extreme delicacy, and becaufe it is formed from the medullary fubftance itfelf, without the admixture of filaments to give it ftrength. He quotes thofe words of Soemmerring: " Continua medulla oritur."

FIFTH PAIR OF NERVES; TRIGEMINI.

THE fifth nerve of the brain arifes from the fore and loweft part of the crura cerebelli, where they unite with the pons varolii. The origin of this nerve may be divided into two portions: an anterior is fmall, and somewhat elevated above the other. The pofterior part of this origin takes its rife a little lower than the anterior part. Thefe two origins of the nerve are connected by a cellular membrane, and have betwixt them a little groove, in which not unfrequently an artery creeps. According to Santorini, the anterior of thefe divifions is formed by the tranfverfe fibres of the pons varolii, and the pofterior by the crura cerebelli *. Vicq d'Azyr could never, except in one diffection, perceive that any of its fibres arofe from the pons varolii †. The nerve of the right fide has been obferved fometimes larger than that of the left.

This fifth nerve, the largeft of the fcull, paffing forwards and downwards, flips in betwixt the lamina of the dura mater, oppofite to the point of the pars petrofum of the temporal bone. It is here firmly attached to the dura mater, and forms a flat irregular plexus. From this plexus there pafs out three great branches :— 1ft, One to the focket of the eye and forehead, through the foramen lacerum; 2d, One to the upper jaw and face, through the foramen rotundum; and 3d, One to the lower jaw and tongue, paffing through the foramen ovale.

SIXTH PAIR OF NERVES; OR, ABDUCENTES ‡.

THE fixth nerve of the fcull feems to arife from betwixt the pons varolii and medulla oblongata. In the

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* Santorinus. Wrifberg de quinto p. Nervor. Scarpa Anat. Annotat. p. 107.

† " Oritur e nodo cerebri, prope cerebellum duabus partibus, &c." Soemmerring.

‡ Or, motores externi.

origin

origin of its fibres it has, however, much variety; and authors differ very much in this point of the defcription*. We may fay, however, that the fixth pair of nerves arife from the corpora pyramidalia.—Sometimes the nerve rifes in two branches, which do not unite until they are entering into the cavernous finus†. The fixth nerve is in fize fomewhat betwixt the third and fourth: it paffes forward under the pons Varolii, until near the lateral and lower part of the body of the fphenoid bone: it thence continues its route forwards and downwards by the fide of the carotid artery, through the cavernous finus: here it feems increafed in fize.—It gives off that fmall twig which anatomifts account the beginning of the great fympathetic nerve. The fixth nerve, after giving off this delicate thread, paffes on through the foramen lacerum to the abductor mufcle of the eye.

SEVENTH PAIR OF NERVES; OR, AUDITORY.

THE feventh nerve arifes from the pofterior and lateral part of the pons Varolii, at the point where it is joined by the crura cerebelli.

But this feventh pair of Willis confifts of two parts; the facial nerve or portio dura, and the auditory or portio mollis; the laft is the larger and pofterior portion‡.

The PORTIO DURA comes out from the foffa formed betwixt the pons varolii, corpora olivaria, and crura cerebelli§; and upon a more careful examination we find it rifing diftinctly from the crus cerebelli.

The origin of the portio mollis, of the feventh pair, is to be traced from the fore-part of the fourth ven-

* Simple as the anatomy of the nerve is, Vieuffens, Morgagni, Lieutaud, Winflow, Sabatier—all differ in their account of the origin of this nerve in fome little circumftance; and Vicq d'Azyr gives fix varieties of it.

† Sabatier. Scarpa loc. cit.

‡ And we may add a third portion; the portio media of Wrifberg.

§ " Foffe de l'eminence olivare," of Vicq d'Azyr.

G G

tricle,

tricle *. We obferve paffing obliquely upwards from the calamus fcriptorius feveral medullary ftriæ; thofe vary in number from two to feven, and are fometimes not to be difcerned †. To thefe are added certain fibres arifing from the pons Varolii, and as thefe fibres proceed from their origin, they become ftill more diftinctly formed into fafciculi. The whole of this portio mollis is larger than the third nerve, firmer than the firft, but lefs fo than the fecond pair; it forms a kind of groove which receives the portio dura. The portio mollis and portio dura entering the meatus auditorius internus of the petrous bone, the former is divided into four portions which pafs to the feveral parts of the internal ear. The latter paffes through the ear, and comes out by the ftylo-maftoid foramen behind the ear, fpreads upon the cheek, and forms the principal nerve of the face.

EIGHTH PAIR OF NERVES.

To underftand a very intricate demonftration, it is neceffary to recollect that the eighth pair of nerves, as they have a relation to the brain, confifts of three diftinct nerves.—Thefe are, 1ft, The GLOSSO-PHARYN-GEAL NERVE; 2d, The PAR VAGUM; 3d, The SPINAL ACCESSORY.—Taken all together, they arife from the fuperior and lateral part of the medulla oblongata.

* Prochafka, fpeaking of the fourth ventricle, continues thus:— " Super has ultimas eminentias folent medullares candicantes quafi " fibræ decurrere, a quibus proprie originem portionis mollis ner- " vorum auditoriorum faltem pro parte deducunt." (Ridley, Hal- ler, Lobftein, cum per antiquo auctore Piccolhomini et etiam recen- tiffimus Soemmerring.—" Ego poftquam multoties in lineas illas " medullares in quarto ventriculo inquifiviffem, dicere poffum, non " femper illas in originem nervi acuftici mollis terminare; nonnun- " quam enim paulo fupra nonnunquam paulo infra definunt, ali- " quando in uno latere, & haud raro utrinque defiderantur, ita ut " ex his obfervationibus perfuadear illas medullares quarti ventri- " culi ftrias ad originem portionis mollis nervi acuftici minime effen- " tiales effe." Prochafka, tab. iii. f. f. Scarp. loc. cit.

† It is a curious circumftance, fhould future obfervation confirm it, which has been mentioned by Santorini, that thofe origins of the auditory nerve have been obferved particularly ftrong in a blind man, whofe hearing had been very acute.

The

The GLOSSO-PHARYNGEAL NERVE is only diftinguifhed within the fcull as a larger filament of the eighth pair; it is however diftinct in its courfe from the origin to the point where it pierces the dura mater: it is the uppermoft of the fibres of this pair of nerves.—Sometimes there is a very delicate filament running parallel with its lower edge which belongs to it. It has the fame origin with the fibres of the par vagum *.

The PAR VAGUM is compofed of ten or twelve very fmall filaments, which are fometimes united into three or four fafciculi. Thefe filaments arife from the outer border of the corpus olivare, or from the lateral part of the medulla oblongata †. Sometimes they arife in a double feries like the nerves of the fpine: a few fibres are to be traced from the fide of the calamus fcriptorius of the fourth ventricle.

The SPINAL ACCESSORY NERVE comes up from the fpine to join the par vagum; it begins by fmall twigs from the pofterior roots of the fourth, fifth, fixth, and even the feventh cervical nerves. In the fize, length, and origin of thofe little flips, there is much variety: as the nerve afcends to the top of the fpine, it connects itfelf with the fub-occipital nerve; it then paffes behind the trunk of the vertebral artery, approaches the par vagum, and receives fome filaments from the medulla oblongata.—Thofe three nerves, the gloffo-pharyngeal, par vagum, and acceffory nerves, in their paffage out of the fcull are connected in a very intricate way ‡. They there feparate from each other. The anterior branch, the

* " Nervus gloffo-pharyngeus fafciculo mox una, mox duabus,
" quatuor, quinque fibris compofito oritur ex fumma atque priore
" parte medullæ pone corpora olivaria nervum facialem inter atque
" nervum vagum, nonnunquam etiam ex quarto ventriculo vel ex
" cruribus cerebelli ad fpinæ medullam, nonnunquam fub pofteriori
" fulco nervi vagi, deductus ab eo vel diftinctius, vel obfcurius in-
" terpofita arteria, vel vena, vel arteria et vena fimul, vel parte
" plexus choroidis, quid quod ipfa directione a nervo vago eft di-
" ftinctus." Soemmering.

† Some filaments, according to Vieuffens, Santorini, and Soemmering, are derived from the paries of the 4th ventricle.

‡ The minutiæ of which will afterwards call for attention.

gloffo-

gloffo-pharyngeal nerve goes to the tongue and pharynx ;
the middle nerve, the par vagum, has an extenfive
courfe through the body, and finally terminates in the
ftomach ; the loweft nerve, the acceffory, paffing into
the neck, perforates the maftoid mufcle, and diftributes
its branches amongft the mufcles of the fhoulder.

NINTH PAIR OF NERVES ; OR, LINGUAL.

THE ninth nerve of the fcull originates from betwixt
the corpora pyramidalia, and olivaria. Like all the
nerves of the fpine, it is compofed of feveral little fila-
ments ; thofe unite into a fafciculus of a pyramidal fhape :
ftill thofe filaments do not form a nerve before perforat-
ing the dura mater, but pierce it feverally * ; they then
unite and pafs out of the fcull by the condyloyd foramen
of the occipital bone ; they are then connected with the
eighth pair and ganglion of the fympathetic nerve.—
The final diftribution of the nerve, is to the mufcles of
the tongue †.

THE TENTH ; OR SUB-OCCIPITAL NERVE.

FROM its origin, its manner of paffing betwixt the
fcull and firft vertebræ, and its diftribution, it muft be
claffed with the nerves of the fpine.

The nerves of the fpine are divided into the eight cer-
vical, twelve dorfal, five lumbar, five, and fometimes
fix or feven, facral nerves ‡. Each of thofe twenty-five

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* The ninth pair of nerves often differ very much in one fide from
the other, in regard to the origin and number of thofe fafciculi.

Scarpa, after fhewing that moft of the nerves have double origin,
defcribes this alfo rifing in two parts. Anat. Annotat. p. 108.

† " Forfan etiam nimio fanguine plena arteria vertebrali preffus
" læditur, ut inde hæfitantia atque refolutio linguæ ebriorum, ex ce-
" rebri phlegmone infanientium, attonitorum explicari poffit.—Col-
" lapfa vero eadem arteria ex nimio fanguinis profluvio lingua ob fan-
" guinis forfan defectum refolvitur.—Ex ejufdem nervi nexu cum ner-
" vis cervicalibus vocis jacturam poft læfam fpinalis medullæ partem
" quæ in cervice eft, explicarunt."

‡ " Plerumque quinque funt, nonnunquam fex, raro tres vel qua-
tuor." Soemmerring.

nerves

nerves arifes in two fafciculi, one from the fore, and the other from the back part of the fpinal marrow. They are to be traced a great way in the length of the fpinal marrow before they pafs the membranes. The pofterior and anterior fafciculi penetrate the dura mater feparately, and afterwards unite. The pofterior fafciculi of the the dorfal nerve before they unite with the other, fwell into a little ganglion. The pofterior fafciculi of the cervical nerves communicate with each other by intermediate filaments.

CHAP. IV.

OF THE PARTICULAR NERVES.

THE FIRST PAIR OF NERVES; OR, OLFACTORY NERVES.

WE have defcribed the three roots of this pair of nerves: their triangular form, their bulbous extremities, and their manner of perforating the cribriform plate of the æthmoid bone.

Where the foft and pulpy-like mafs of the olfactory nerves perforates the æthmoid bone, the dura mater involves them, and gives them firm coats *. There are two fets of nerves thus formed. Firft, thofe which pafs through the holes in the cribriform plate, neareft the crifta galli, run down upon the feptum of the nofe, under the fchneiderian membrane, and betwixt it and the periofteum; they become extremely minute as they defcend; and they, finally, pafs into the foft fubftance of the membrane.

* Duverney firft obferved this courfe and firmnefs of the olfactory nerves.

The

The fecond clafs of filaments are thofe which pafs down by the outer fet of holes of the æthmoid plate, and which are diftributed to the membrane invefting the fpongy bones.

Although branches of the ophthalmic, pterigoid, palatine, and fub-orbital nerves pafs to the membrane of the nofe, there is reafon to believe that they have no power of conveying the impreffion of odours. Thefe nerves are neceffary that the membrane may poffefs the common properties beftowed by the nerves.

Upon the queftion, whether thofe additional branches of nerves to the nofe, affift in conveying the impreffion of odours, there has been much controverfy. It is a fubject upon which we might reafon by analogy; but, certainly, little dependence can be placed upon thofe cafes brought by either party, of difeafes affecting the one fet of nerves without influencing the other. From the nature of the parts, ulceration or tumors, which deftroy the bones of the nofe, muft prefs equally upon the branches of the olfactory nerve, and of the fifth pair. We find that there pafs alfo to the other organs of fenfe, fubordinate nerves; and we know that a nerve may be modified to much variety of function; and this is evident from the nerve of tafte being a branch of the fifth pair. But it is doubtful how far a nerve may be capable of receiving at one inftant various impreffions. Far from confidering diftinct nerves fent to the fame organ, as affording an argument for thefe nerves receiving one uniform impreffion, and conveying one fimple fenfation, it would feem more rational to infer, that one individual nerve cannot perform two functions, and that two functions are often required in the organs of fenfe. I am inclined to believe, that the olfactory nerve is incapable of beftowing common fenfation on the membrane of the nofe; and that the other nerves which ramify on that membrane, do, on the other hand, contribute nothing to the fenfe of fmell, as we find that the inflammation of the pituitary membrane, which raifes the fenfibility of the branches of the fifth pair of nerves, does in no degree make thofe of the olfactory nerve

lefs

lefs acute. The membrane is painfully inflamed, but the fenfe of fmell is deadened. In attending to the delicate fenfibility of the nerves of the fenfes, we neglect to take into account the lefs prominent, but no lefs curious peculiarities in the fenfations, and fympathies of the common nerves. The fenfes of tafte or fmell are not more diftinct from each other, or from common fenfation, than are the peculiar fenfations which belong to the fenfibility of the feveral vifcera. The ftomach and inteftinal canal poffefs as great a difcriminating power as the organ of tafte, although the fenfations are lefs perfectly conveyed to the fenforium. There is a variety in the fufceptibility of the feveral organs and vifcera, a diftinct fenfation and proportioned action and election which is effential to the order and œconomy of the general fyftem. This is confpicuous in the variety of the affections in remote parts, when food, medicine, or poifon is received into the body. Thefe peculiarities in the impreffion of which each organ is fufceptible, are fo far diftinct as to be effential to the due excitement of that organ ; and are yet fo general, as to connect, in one combined action, the whole fyftem, and to occafion fympathies in remote parts, which perplex us, and give that degree of intricacy to the living actions, which renders medicine an uncertain art.

ARRANGEMENT OF THE NERVES PROCEEDING FROM THE CRANIUM.

THE firft nerve we have feen paffing to the nofe.

The fecond, third, fourth, part of the fifth and fixth, pafs to the eye, or through the orbit.

The feventh nerve is that which becomes the organ of hearing.

Part of the fifth, feventh, eighth, ninth, and fub-occipital nerves pafs to the bones of the face, the integuments and mufcles of the face, the jaw, and throat.

From the fixth pair of nerves is derived the great fympathetic ; from the eighth is fent downwards the par vagum.

The

The extreme branches of the fifth pair, of the seventh, of the eighth, ninth, and first cervical nerves, form a chain of connections, furrounding the head, face, and neck.

SECOND PAIR; OR OPTIC NERVES.

In this part of the work there is no occasion to deliver any thing further concerning the optic nerves, than has been already said of their origin, and final expansion in the retina of the eye. It will be more proper to confider them fully when treating of the eye in particular.

THIRD PAIR OF NERVES; OR MOTORES OCULORUM.

These nerves have the name of motores oculorum, becaufe they are diftributed to the mufcles which move the eye-balls. They pafs upwards from their origin; and then diverging, they penetrate the dura mater under the extreme point of the tentorium; they defcend again by the fide of the cavernous finus, and pafs out of the cranium by the foramen lacerum of the fphenoid bone.

The nervus motor oculi having come into the focket divides into two branches: The INFERIOR BRANCH paffes forward along the outfide of the optic nerve; it then divides into thefe branches:

   1. To the adductor mufcle.
   2. To the rectus inferior.
   3. To the external oblique and to the lenticular ganglion.

But the branch of the third nerve, which, with the fifth, forms this little ganglion, is, by no means, conftantly derived from this branch. The LESSER and SUPERIOR BRANCH of the third, is diftributed to the rectus fuperior oculi and levator palpebræ fuperioris.

FOURTH PAIR OF NERVES, TROCHLEARES; OR PATHETICI.

THESE nerves are very fmall. Their origin, from about the tubercula quadrigemina, and their long courfe under the bafe of the brain, have been already defcribed; after proceeding a confiderable way, incafed in the duplicature of the dura mater, where it forms the extreme point of the tentorium, they pafs amongft the lamellæ of the dura mater, where it forms the cavernous finus. They pafs by the outfide of the third pair of nerves; turn round fo as to be above them, and make their egrefs through the foramen lacerum of the fphenoid bone. They pafs forward in the orbit, undiminifhed by the giving off of branches; and are each finally diftributed to the fuperior oblique mufcle or trochlearis. Sometimes, however, in their courfe, they fend branches to unite with thofe of the fifth pair, which pafs to the nofe, or even to the frontal nerve; but this is very rare *.

As this nerve is derived very far back from the brain, and as the parts from which it originates are lefs affected by the diftention of the ventricles than almoft any other part of the brain, this has been given as a reafon why in hydrocephalus we fo frequently fee the eyes turned obliquely towards the nofe. The origins of thefe nerves being lefs affected, they will give a comparatively greater power to the fuperior oblique mufcle. It has been obferved alfo, that in death the power of the fuperior oblique mufcle is greater than the other mufcles of the eyeball. I account differently for thefe phenomena.

THE FIFTH PAIR, OR TRIGEMINI.

THE tracing of the branches of the fifth pair, by diffection, is a difficult tafk, for thofe branches are diftributed among the bones of the face, to the eyes, nofe, mouth, tongue, and throat. From this extenfive diftri-

* Soemmerring.

bution

bution the fifth nerve is neceffarily the largeft of thofe that pafs out of the cranium.

It is of a flattened form *; it penetrates the dura mater at the anterior point of the petrous bone, and fpreads flat under it. Here, under the dura mater, it is matted into one irregular ganglion; *viz.* the femilunar, or Gafferian ganglion. This ganglion lies on the anterior point of the temporal, and on the fphenoidal bone. In their paffage from the brain, the filaments, compofing the fifth nerve, are loofe, or eafily feparated; at this place, they are all found fo fubdivided and entangled, as to refift further divifion. The nerve here fwells out into a greater fize; it feems to be incorporated with the denfe fibres of the dura mater; it becomes of a dark-red, or mixed colour; all which circumftances have, by no means, been unobferved by anatomifts. Vieuf-fens fuppofed, that the ufe of this ganglion, of the fifth pair, before it perforates the cranium, was to ftrengthen the nerve, and enable it to withftand the motion of the jaws! But it would rather feem to be a ganglion con-necting in fympathy all thofe parts to which the nerve is finally diftributed †.

The connection of the Gafferian ganglion with the dura mater, is fo firm, that it yet remains undecided, whether there are fent off here any nerves to that mem-brane; but I conceive, that there are none, and that the connection of the ganglion with the fibrous mem-brane, or fheath which covers it, has been miftaken for nerves paffing from the ganglion to the dura mater.

From the femilunar or Gafferian ganglion, the fifth nerve divides into three great branches; whence the name of trigeminus:

1ft, The OPHTHALMIC BRANCH of WILLIS, which paffes through the foramen lacerum into the orbit.

2d, The SUPERIOR MAXILLARY NERVE, which paffes through the foramen rotundum.

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* So it is faid, by Miekel, to refemble the flat worm, or tænia.
† " Et affectum animi indicia in faciei partibus depingere adju-vet." Hirfch. Sand. Thef. Diferta. p. 491.

3d, The

3d, The INFERIOR MAXILLARY NERVE, which paf-
fes to the lower jaw, through the foramen ovale.

The ophthalmic branch of the fifth pair.

This nerve enters the orbit in three divifions, thefe
are, the *frontal*, the *nafal*, and the *lachrymal* nerves.

1ft, The firft of thefe runs under the periofteum of
the upper part of the orbit, and above the levator pal-
pebræ fuperioris. Upon entering the orbit it gives off
a fmall branch, which paffes to the frontal finus; the
nerve then divides into the fuper-trochlearis, and the
proper frontal nerve. The firft of thefe paffes to the
inner part of the orbicularis oculi and frontal mufcle.
The other, the outermoft, and the proper frontal nerve,
paffes through the hole, or notch, in the margin of the
orbit, and mounts upon the mufcles and integuments of
the forehead. Thefe fuperficial branches communicate
with the extreme branches of the portio dura, or nervus
communicans faciei.

Cafes are on record of wounds of the frontal nerve
occafioning a great variety of nervous fymptoms, and
efpecially lofs of fight; and it certainly marks a very
particular connection and fympathy betwixt this branch
and the common nerves which pafs to the eye-ball and
iris, and the retina, that blindnefs is actually occafioned
by the pricking of the frontal nerve. Morgagni fup-
pofes this to be occafioned by the fpafmodic action of
the recti mufcles preffing the globe of the eye down
againft the optic nerve. It is alfo remarkable, that im-
preffions acting folely on the retina, will convulfe the
mufcles of the eye, give them irregular contractions,
and confequently diftort the eye-ball and produce blind-
nefs. Such has been found to be the effect of lightning
in fome inftances.

2d, The NASAL BRANCH of the ophthalmic nerve
fends off a flip or twig to form with a branch of the
third pair, the LENTICULAR or OPHTHALMIC GANG-
LION; while the trunk of the nerve paffes obliquely
forwards, and inward through the orbit, and gives off

5   one

one or two extremely fmall twigs, which join the fafci-
culi of ciliary nerves. The nafal branch then continues
its courfe betwixt the fuperior oblique and adductor muf-
cles; before piercing the orbital plate, it fends forward
a branch, which paffing under the pulley of the fuperior
oblique mufcle, joins that divifion of the frontal nerve
which paffes over the pulley. The nafal nerve then paf-
fing through the internal orbital foramen, enters the fcull
again, and runs under the dura mater, which covers
the æthmoid bone, to pafs through the cribriform plate
of that bone, and again to efcape from the cranium. It
is finally diftributed to the upper fpongy bones, and to
the frontal finufes.

We thus obferve fuch a connection of the nerves of
the eye and nofe, and of thofe diftributed to the inner
angle of the eye, and mufcles of the eye-lids, as fuf-
ficiently accounts for the fympathy exifting among thofe
parts. We fee the neceffity of this connection, fince
the excitement of the glands which fecrete the tears, the
action of the mufcles, and the abforption of the tears
into the nofe, muft conftitute one action.

The LENTICULAR, or, OPHTHALMIC GANGLION,
comes naturally to be confidered under this divifion of
the fifth pair. The lenticular ganglion is formed by a
twig from the nafal branch of the fifth pair, after being
united to that branch of the third pair of nerves, which
goes to the levator palpebræ and the rectus fuperior muf-
cles. The ganglion is of a fquare form, and is fituated
upon the outfide of the optic nerve. The ciliary nerves
pafs out from this ganglion in two fafciculi; they are
ten or twelve in number; they are joined by branches of
the continued nafal nerve. The ciliary nerves run for-
ward amongft the fat of the orbit, to the fclerotic coat
of the eye, and pierce it very obliquely in conjunction
with the ciliary arteries. The ciliary nerves and arteries
then pafs forward betwixt the fclerotic and choroïd
coats of the eye to the iris. The iris is confidered as
the part the moft plentifully fupplied with nerves (as it
certainly is alfo with arteries) of any part in the body.
                                                    It

It follows, indeed, from what we formerly faid, that a profufe circulation of blood is neceffary to an accumulated nervous power.

From the connection of thefe ciliary nerves with thofe paffing to the nofe, Soemmerring accounts for fneezing being the confequence of a ftrong light upon the eye. This may perhaps be true; but, certainly, the temporary lofs of light, from fneezing, does not depend upon this connection of the nerves, but upon the immediate affection of the optic nerve and retina, from the concuffion and interruption to the circulation, or upon the accumulation of blood in the eye.

2. The LACHRYMAL NERVE is the leaft of the three divifions of the ophthalmic nerve; it divides into feveral branches before it enters the gland. Several of thefe branches pafs on to the tunica conjunctiva, being joined by twigs of the firft branch of the fuperior maxillary nerve. Others connect themfelves with the extremities of the portio dura of the feventh pair, and with the fuperior maxillary nerves.

THE SECOND BRANCH OF THE FIFTH PAIR; VIZ. THE SUPERIOR MAXILLARY NERVE.

THE fuperior maxillary nerve, having paffed the foramen rotundum, emerges behind the antrum highmorianum, at the back part of the orbit, at the root of the pterigoid procefs of the fphenoid bone. The infra-orbital canal lies directly oppofite, and ready to receive one branch, while the fpheno-maxillary, opening into the orbit, is above, ready to receive another. The chief part, or trunk, of the nerve may be faid to be feated, and to give out its divifions in the pterigo-palatine foffa. Through the fpheno-maxillary hole, the firft branch of the fuperior nerve is fent into the focket of the eye. This twig unites with branches of the lachrymal nerve, and in general fupplies the periofteum of the orbit. It then fends, through the foramen in the os malæ, a branch which is diftributed to the orbicularis mufcle of
the

the eye-lid, and communicates with the branches of the
portio dura of the feventh pair, or nervus communicans
faciei.   Another branch of this firft divifion paffes up-
ward from the zygomatic foffa, in a groove of the wing
of the fphenoid bone, to the temporal mufcle, and get-
ting fuperficial, it accompanies the branches of the tem-
poral artery.

Independently of this branch, which paffes upwards
to the temporal mufcle, Miekel, in his firft differtation
on this nerve, divides its branches into four: 1ft, The
infra orbital; 2d, The defcending branch, which again
gives off the vidian and nafal nerves;   3d, The palatine
nerve and pofterior alveolar nerve.   It was not till after-
wards that he difcovered the ganglion which takes his
name; and, of courfe, the previous defcription muft be
imperfect.   The fuperior maxillary nerve, after fending
off the fmall branches which I have defcribed to enter
the orbit, having fairly emerged out of the cranium,
fends down two fmall branches which, uniting, form a
fmall ganglion of a redifh colour, and of a triangular
fhape, like a heart. This, the SPHENO-PALATINE GANG-
LION, or ganglion of Miekel, is exactly oppofite to the
fpheno-palatine hole; and thofe nerves, and this gang-
lion are immerfed in the foft fat which fills up the fpace
betwixt the fphenoid palatine and fuperior maxillary
bones.

From this ganglion are fent out feveral leffer nerves,
and particularly the nafal, vidian, and palatine nerves.

The SUPERIOR NASAL BRANCHES pafs to the mem-
brane on the back part of the nofe, and to the cells
of the fphenoid bone.

The VIDIAN NERVE comes off from the back part of
the ganglion, and paffes into the foramen pterigoideum
backwards.   It firft gives off fome fmall branches to the
nofe (the fuperior and pofterior nafal nerves of Miekel);
thefe perforating the bone laterally, are diftributed on
the pituitary membrane, covering the vomer.   The
vidian nerve continuing its courfe backwards, fplits;
one branch, after a long retrograde courfe through the
petrous

petrous part of the temporal bone, forms a connection with the portio dura, while the other forms one of the roots of the great fympathetic nerve, by joining the branch of the fixth pair, which paffes down with the carotid artery.

From the diftribution of this branch of the fifth pair to the membrane of the nofe, and its connection with the fympathetic, fome phyfiologifts account for the effects of odours in caufing fainting, as the chief nerves of the heart are received from the fympathetic. They alfo account thus for the excitement of the heart, in deliquium, by ftimulant applications to the nofe.

The PALATINE NERVE is the largeft of the branches fent out from the ganglion. We have to recollect, that there are two canals in the bone conveying nerves to the palate; one anterior and larger; and another running nearly parallel to it, a pofterior and fmaller one. The divifion of the palatine nerve, which defcends through the anterior palatine hole, is of courfe the larger branch; as it paffes through the canal, it gives branches which enter the nofe, to be diftributed upon the pituitary membrane. This larger branch, in its further progrefs through the bone, divides, and having emerged from its hole, is diftributed all along on the foft palate. The pofterior divifion of the palatine branch, paffing down by the pofterior palatine foramen, is diftributed to the velum pendulum palati and its mufcles.

There is yet a third branch of the palatine nerve; viz. the external palatine nerve. It is the leaft of all the branches; and, fometimes, inftead of coming from the ganglion, is derived immediately from the fuperior maxillary nerve. This branch defcends before the pterigoid proceffes, and on the convex furface of the upper maxillary bone, and is diftributed to the velum palati and uvula.

The fuperior maxillary nerve, after fending off the branches which form the fpheno-palatine ganglion, paffes obliquely downward to the infra orbital canal. In this courfe it gives off the pofterior nerve to the

teeth

teeth of the upper jaw; and this again gives off a twig, which takes a courfe on the outfide of the maxillary bone, and fupplies the gums and alveoli, and buccinator mufcle.

While paffing in its canal, the infra-orbital nerve gives off the anterior nerve to the teeth; and when it emerges from the infra-orbital foramen, it fpreads widely to the mufcles of the face, connecting itfelf with the extremities of the portio dura of the feventh pair or nervus communicans faciei.

The "tic douloureux," and the "tic convulfif," of the French authors, are difeafes attributed to the affection of this nerve. The feat of the tic douloureux is the fide of the face, the noftril, the cheek-bone, and root of the alveoli. Sauvage calls it the trifmus dolorificus, or maxillaris. But it is a difeafe not abfolutely fixed to this point of the cheek-bone; but on the contrary, from the univerfal connection betwixt the nerves of the face, it takes, fometimes, a wide range; and the difeafe, I have no doubt, is fometimes feated in the portio dura of the feventh pair. Sauvage has given to one fpecies of it, the name of occipitalis.

It is a difeafe attended with extreme pain, which forces the patient to cry out in great agony. The pain is felt deep rooted in the bones of the face, and feems to fpread upon the expanded extremities of the nerve; it is fudden, violent, and reiterated in its attack, and it varies in the length and repetition of its acceffion. It is confined chiefly to thofe advanced in years, and is as violent in the day as during the night; and in the advanced ftate of the difeafe, when the face is fwelled, the flighteft touch will excite the pain.

This difeafe is apt to be confounded with the affection of the antrum highmorianum, the tooth-ach, rheumatifm, and clavis hyftericus, or even with venereal pains. It has been cured by dividing the infra-orbital nerve, but this is an uncertain remedy.

In hemicrania, the affection of the three branches of the fifth nerve, is fuch as to mark their diftributions.
There

There is fwelling and pain of the face, pain of the up-
per maxillary bone, pains in the ear and in the teeth,
difficulty of fwallowing, and laftly, ftiffnefs in moving
the lower jaw, in confequence of the affection of thofe
branches which pafs up to the temporal mufcle.

There are cafes fpoken of by Sabatier, where this
infra-orbital nerve being wounded, unufual nervous affec-
tions, and even death, were the confequence: but it
would rather appear, that, independently altogether of
the affection of the nerves of the face, inflammation
fpreading from the wound to the brain, had, in the ex-
amples which he gives, been the occafion of the unufual
fymptoms, and of the death of the patients.

THIRD BRANCH OF THE FIFTH PAIR; OR, LOWER MAXILLARY NERVE.

THIS, the laft of the three great divifions of the fifth
pair of nerves, the largeft but the fhorteft branch with-
in the fcull, paffes out by the foramen ovale. It is dif-
tributed to the mufcles of the lower jaw, tongue, and
glands. The trunk of the nerve having efcaped from
the cranium, lies covered by the external pterigoid muf-
cle; and is at this point divided into two great branches,
which again fubdivide into numerous fmall branches;
many of which it would be fuperfluous to defcribe. It
is fufficient to mention them as going, 1, to the maf-
feter mufcle; 2, to the zygomatic foffa and temporal
mufcles; 3, to the buccinator mufcle.

We regard as the two greater divifions of this nerve,
the proper maxillary nerve which paffes into the lower
jaw; and the guftatory or lingual nerve; the divifion
into thefe two great branches is formed, after the nerve
has paffed the pterigoid mufcles.

The GUSTATORY NERVE, immediately after its fepa-
ration from the nerve of the lower jaw, is joined by
the chorda tympani; or, perhaps we fhould rather fay,
a branch of this nerve, by traverfing the petrous por-
tion of the temporal bone in a retrograde direction,

unites itself with the portio dura of the seventh pair, as
it is passing through the ear. This nerve being seen
passing across the tympanum, is the reason of its being
called CHORDA TYMPANI. The gustatory nerve, pro-
ceeding obliquely downward, sends off twigs to the
salivary glands and muscles, situated betwixt the jaw-
bone and tongue. Where it is passing by the side of
the maxillary gland, it gives out some filaments which
form a small ganglion, from which branches penetrate
the gland. The trunk then proceeding onward betwixt
the sub-lingual gland and the musculus hyo-glossus, se-
veral twigs are sent off, which form a kind of plexus
amongst the muscles and salivary glands; and com-
municating with the ninth pair of nerves, are dis-
tributed, finally, to the gums and membrane of the
mouth.

The gustatory nerve terminates in a lash of nerves,
which sink deep into the substance of the tongue, be-
twixt the insertion of the stylo and genio-glossal muscles.
These pass to the papillæ on the surface of the tongue.
The sense of taste, the impression of which is received
upon this nerve, is seated in the edge and anterior part
of the tongue: the action of the tongue against the
palate forces the sapid juice of the morsel to extend to
the edge of the tongue.

The proper lower maxillary nerve, which enters into
the lower jaw-bone, sometimes called *mandibulo labralis*,
passes downward in an oblique direction to the groove
of the lower jaw-bone. Before this nerve enters the ca-
nal of the bone, it gives off branches to the mylo-hyoideus
and digastricus, to the sub-maxillary glands and to the
fat. The nerve then entering the bone, runs its course
all the length of the lower jaw within the bone, and
comes out at the mental hole. In this course it gives
branches which enter the roots of the teeth, and accom-
pany the branches of the arteries. When this lower
maxillary nerve has escaped from the mental hole, it
divides into two branches upon the chin; one of these
is distributed to the orbicularis and depressor anguli oris,
                                                      and

and to the ſkin and glands of the lips ; the other to the
depreſſor labii inferioris and integuments, and forms a
kind of plexus, which ſurrounds the lips. Theſe nerves
are alſo connected with the wide-ſpreading branches of
the portio dura of the ſeventh pair ; and they are the
loweſt branches of the facial nerves, and the laſt enu-
merated of the intricate branches of the fifth pair.

THE SIXTH PAIR OF NERVES ; ABDUCENTES, OR MOTORES EXTERNI.

The fixth pair of nerves, as we have ſeen, ariſes be-
twixt the tuber annulare and the corpus pyramidale.
Advancing forwards and upwards, ſometimes above and
ſometimes beneath the branches of the baſilar artery, it
penetrates the dura mater by the ſide of the baſilar
ſinuſes. It then paſſes by the ſide of the carotid artery,
and through the cavernous ſinus. Here it gives off fila-
ments, which, clinging to the carotid artery, deſcend
with it until they are joined by a branch of the vidian
nerve. Theſe together form the origin of the great
ſympathetic nerve. It is a diſputed point, however,
whether this be a branch given out from, or received
into, the fixth pair ; and in the deſcription of the fixth
pair, we might ſay, with equal ſhow of reaſon, that as it
paſſes the carotid artery, it receives one or more nerves
which come up through the carotid hole, and encircle
the nerve. The fixth pair enters the orbit by the fora-
men lacerum, with the third and fourth pairs, and
firſt branch of the fifth. It pierces the abductor muſ-
cle of the eye before it is finally diſtributed to its ſub-
ſtance.

It has been preſumed, that the fixth nerve does not
give off the ſympathetic nerve, but receives thoſe
branches from it, becauſe the fixth nerve is larger be-
twixt this point and its diſtribution in the orbit, than
betwixt the ſame point and its origin from the brain.
But I conceive, that this enlargement of the fixth pair
is not owing to ſuch a junction ; but that, on the con-

H H 2   trary,

trary, the nerve naturally swells out when it enters the sinus, not from being soaked in the blood of the sinus, but from its having additional investing coats, or from the coats being strengthened in order to prepare the nerve for its passage through the blood of the sinus.

Again, that the sympathetic nerve sends up those branches to join the sixth, has been presumed from the effects of experiments on brutes in which the sympathetic nerve has been cut or bruised. But I should not be apt to give implicit credit to the result of these experiments. Supposing that the sympathetic in the neck gave an origin to the sixth pair, should not paralysis of the abductor muscle of the eye, and in consequence of this, the turning of the eye towards the nose, be the effect of cutting the sympathetic? On the contrary, inflammation and heaviness of the eye has been observed.

We shall probably cease to dispute this point, when we consider the relations and use of the sympathetic nerve.

The sympathetic nerve may be defined, a tract of medullary matter, passing through and connecting the head and neck, the viscera of the thorax, abdomen, and pelvis, into one whole. The sympathetic nerve is singular in this, that it takes no particular origin, but has innumerable origins, and a universal connection with the other nerves through all the trunks of the body. Those viscera to which it is distributed are entirely independent of the will, and have functions to perform too essential to life to be left under the influence of the will. The sympathetic nerve is thus, as it were, a system within itself, having operations to perform of which the mind is never conscious; whilst the extent of its connections occasion, during disease, sympathetic affections not easily traced.

It is impossible seriously to consider the sixth nerve as giving the origin to the sympathetic in any other light, than as such an expression may be subservient to arrangement, description, and general enumeration of the

the nerves;—a thing moſt neceſſary in ſo intricate a piece of anatomy.

OF THE SEVENTH PAIR OF NERVES.

THE nerves of the ſeventh pair conſiſt each of two faſciculi, which ariſe together, and paſs into the foramen auditorius internus *. But theſe portions do not paſs through the bone in union; for the anterior and leſſer faſciculus, is a common nerve, which paſſes through to the face, and is inveſted, like the common nerves of the body, with ſtrong coats. It is therefore called the PORTIO DURA †. The more poſterior faſciculus is the auditory nerve, and is diſtributed to the organ within the pars petroſa of the temporal bone; and in diſtinction it is called the PORTIO MOLLIS.

The PORTIO DURA, or NERVUS COMMUNICANS FACIEI, in paſſing from the brain to the internal auditory foramen, is lodged in the fore-part of the auditory nerve, as in a groove. When it leaves the auditory nerve, it paſſes on through the bone, and emerges on the ſide of the face through the ſtylo-maſtoid foramen at the root of the ſtyloid proceſs, ſo as to come out betwixt the lower jaw and the ear, covered, of courſe, by the parotid gland. The portio dura, while paſſing through the canal of the temporal bone (which is the aqueduct of Fallopius), gives off a branch which unites with the vidian nerve of the fifth pair; or rather, we may conclude with the beſt authors, that it receives a branch which comes retrograde from the vidian nerve, paſſing through the ſmall hole on the anterior ſurface of the petrous part of the temporal bone. The portio dura, when it has proceeded onwards by the ſide of the tympanum, gives off one or more very minute branches to

* The intermediate filaments of Wriſberg, which is betwixt theſe two portions of the ſeventh nerve, is afterwards united to the portio dura, and muſt be conſidered as one of its roots.

† Galen divided all the nerves of the brain into thoſe two claſſes, _mollis_ and _dura_; of which the firſt were thoſe of the ſenſes, the latter the motores corporis.

the

the mufcles within the tympanum, which give tenfion to the fmall bones of the ear. A little further on, this nerve gives off a more remarkable branch, which, paffing acrofs the tympanum, is called CORDA TYMPANI. This is the branch which, as we formerly mentioned, joins the guftatory branch of the lower maxillary nerve. The corda tympani paffes through the tympanum betwixt the long procefs of the incus and the handle of the maleus; then, received into a groove of the bone, it paffes by the fide of the Euftachian tube, and after enlarging confiderably, it is united with the guftatory nerve.

When the portio dura, or nervus communicans faciei, has efcaped from the ftylo-maftoid foramen, but is yet behind the condyle of the lower jaw, and under the parotid gland, it gives off, 1ft, The pofterior auris. This has connection with the firft cervical nerve, and paffing up behind the ear, it is connected with the occipital branches of the third cervical nerve. 2d, The nervus ftylo-hyoideus to the ftyloid mufcles, and to unite with the fympathetic. 3d, A branch which fupplies fome of the deep mufcles, and joins the laryngeal branch of the eighth pair.

The portio dura, rifing through the parotid gland, fpreads out in three great divifions:

1. An ASCENDING BRANCH, which divides into three temporal or jugal nerves; fo called, becaufe they afcend upon the jugum, or zygomatic procefs. Two orbitary nerves, which, paffing up to the orbicularis mufcle, branch upon it, and inofculate with the extremities of the fifth pair.

2. The FACIAL NERVES. The fuperior facial nerve paffes out from the upper part of the parotid gland, acrofs the face to the cheek and orbicularis mufcle of the eye. The middle facial nerve paffes from under the riforius Santorini; it goes under the zygomatic mufcle, and encircles the facial vein; it fends branches forward to the lips, and upwards to the eye-lids, and to unite with the infra-orbital nerve. There is an inferior facial nerve,

nerve, which comes out from the lower part of the parotid gland, paffes over the angle of the jaw, and is diftributed to thofe fibres of the platyfma myoides which ftretch up upon the face, and to the riforius Santorini : it paffes on to the angle of the lips, and is diftributed to their depreffor mufcle. Betwixt thofe facial nerves there are frequent communications, while they are at the fame time united with the extremities of feveral branches of the fifth pair.

3. The DESCENDING BRANCHES pafs along the margin of the jaw, down upon the neck, and backward upon the occiput. Thus we fee that the communicating nerve of the face is well named.—It is diftributed to the fide of the face, head, and upper part of the neck : it unites its extreme branches with thofe of the three great divifions of the fifth pair, with the eighth and ninth, with the acceffory of the eighth pair, with the fecond and third cervical nerves, and with the fympathetic. From thofe various connections it has been called the leffer fympathetic. As to the fympathies which phyficians have thought fit to afcribe to the connections of this with other nerves, as in laughing, weeping, kiffing, &c. they would be tedious to enumerate, and by no means inftructive.

The PORTIO MOLLIS of the feventh pair of nerves is the acuftic or auditory nerve ; which fhall be confidered in a more diftinct and particular manner, when we defcribe the other parts of the organ of hearing.

The nerves which we have now defcribed are connected with the anatomy of the head, and circulate chiefly around the bones of the face. Thofe we are next to confider extend their branches to the neck, and form there a very intricate piece of anatomy, while a clafs of them ftill more important, pafs down to the vifcera of the breaft and belly.

THE EIGHTH PAIR OF NERVES.

THE fafciculus, which, proceeding from the medulla oblongata, paffes out of the cranium by the fide of the

great lateral finus, and which, in the view we have of the nerves upon raifing the brain from the cranium, is properly enough confidered as the eighth pair, confifts in truth of three diftinct nerves.   Thefe are the GLOSSO-PHARYNGEAL NERVE, the PAR VAGUM, and the SPINAL ACCESSORY NERVE OF WILLIS.

THE GLOSSO-PHARYNGEAL NERVE.

THIS nerve, parting from its connection with the par vagum and acceffory nerves, perforates the dura mater feparately from thefe, and in many fubjects, paffes through an offeous canal diftinct from the par vagum. When it efcapes from the cranium, it lies deep under the angle of the jaw, and paffes acrofs the internal ca-rotid artery upon its outer fide.   It is to be feen by lifting the ftyloid mufcles, at which point it fends fmall branches to the ftyloid and digaftric mufcles, and to join the par vagum.   It fends alfo fome very fmall twigs down upon the internal carotid artery; fome of which join that pharyngeal branch * which is formed from the par vagum and acceffory nerve.

Thefe branches united form a fmall irregular ganglion, from which again pafs off numerous branches to the conftrictor mufcles of the pharynx.

The trunk of the gloffo-pharyngeal nerve, after giving off thofe nerves which pafs in the direction of the in-ternal carotid artery, continues its courfe attached to the ftylo-gloffal and ftylo-pharyngeal mufcles, to which of courfe it gives more branches, and alfo to the upper divifion of the conftrictor pharyngis.   A divifion of the extreme branches of this nerve terminates in the tongue, under the denomination of RAMI LINGUALES PROFUNDI,

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* This is a branch to the pharynx which is formed by the par vagum and the fpinal acceffory of Willis.   After this nerve is formed, it again forms connection with the par vagum.—Pain in the throat having been obferved by Galen to extend to the back, Scarpa explains it on the ground of this connection with the fpinal acceffory nerve.

RAMI LINGUALES LATERALES, NERVI GLOSSO-PHA-
RYNGEI *.

It appears to me that thefe branches are diftributed
amongft the fhort mufcles of the tongue, and perhaps to
the large papillæ upon the moft pofterior part of the
tongue. Amongft the branches of the pharyngeal nerve
is to be enumerated that which turns back to join the
ninth pair in its diftribution to the tongue †. The re-
maining branches of the gloffo-pharyngeal nerve, are
diftributed in innumerable filaments upon the pharynx,
in which they are affifted by branches from the ganglion
of the fympathetic nerve.

THE PAR VAGUM.

THE par vagum is the great and important divifion of
the eighth pair. It is the middle fafciculus of the three
nerves as they lie within the fcull. In its exit, it is fe-
parated from the internal jugular vein by a thin bony
plate ; and fometimes two or three fibres of the nerve
pafs the bone diftinct from the others, and afterwards
unite into the proper trunk of the par vagum. Deep
under the lower jaw and the maftoid procefs, the gloffo-
pharyngeal nerve, the par vagum, the fpinal acceffory,
the fympathetic nerve, the portio dura of the feventh,
and the upper cervical nerves, are entangled in a way
which will fatigue the diffector, and may account for
every degree of fympathy of parts. The par vagum,
lying behind the internal carotid artery, and as it were,
efcaping from the confufion of the ninth acceffory and
gloffo-pharyngeal nerves, defcends and fwells out into a
kind of ganglion ‡. We now obferve three branches to
be fent off : The FIRST and SECOND PHARYNGEAL
NERVES, which pafs to the conftrictor phaLyngis
mufcle, and the INTERNAL LARYNGEAL NERVE.

* Scarpa.   † Sabatier.

‡ *Truncus gangliformis* OCTAVI, *tumidulum, corpus olivare* Fal-
lopii ; but it is fufpected that in this he meant the ganglion of the
fympathetic nerve.

This

This laft mentioned nerve is even larger than the gloffo-
pharyngeal nerve. It is behind the carotid artery, and
paffes obliquely downward and forward. In its pro-
grefs the principal branch paffes under the hyo-thyroideus
mufcle, and betwixt the os hyoides and the thyroid
cartilage; while others, more fuperficial, pafs down and
are connected with the EXTERNAL LARYNGEAL, or
PHARYNGO-LAYNGEUS; which is a nerve formed by
the fympathetic and par vagum conjointly. The prin-
cipal branch of the internal laryngeal nerve, which runs
under the hyo-thyroideus, is diftributed to the fmall
mufcles moving the cartilages. The minute extremities
of this nerve pafs alfo to the apex of the epiglottis, and
the glandular membrane covering the glottis. We have
at the fame time to remark a very particular communi-
cating nerve betwixt this internal laryngeal nerve, and
the recurrent branch of the par vagum. This branch
is defcribed by Galen. The par vagum continues its
uninterrupted courfe betwixt the carotid artery and ju-
gular vein, and is involved in the fame fheath with thefe
veffels. In this courfe down the neck, it fometimes
fends back a twig which unites with the ninth pair, and
when near the lower part of the neck, it fends forward
twigs to unite with thofe from the fympathetic nerve,
which pafs down to the great veffels of the heart, to
form the fuperior cardiac plexus*. On the right fide,
thofe nerves to the great veffels are in general given off
by the recurrent nerve.

The par vagum now penetrates into the thorax by
paffing before the fubclavian artery; it then fplits into
two. The main nerve paffes on by the fide of the tra-
chea, and behind the root of the lungs; while the
branch, on the right fide, turns round under the fub-
clavian artery, on the left, under the arch of the äorta,
and afcends behind the trachea to the larynx.

This afcending branch of the par vagum is the RE-
CURRENT NERVE. On the right fide it is fometimes

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* The courfe of thefe nerves to the heart, is beft treated of with
the branches of the fympathetic nerve.

double. It afcends behind the carotid artery, and fometimes is thrown round the root of the thyroid artery. On the left fide, which, from its turning round the arch of the aorta, is much lower than on the right, it gives off filaments which go to the lower cardiac plexus, after having united with the branches of the fympathetic. Under the fubclavian of the right fide, alfo, there are fent branches from the recurrent to the cardiac plexus ; and on both fides there pafs branches of communication betwixt the fympathetic nerve and the recurrent. When the recurrent nerve has turned round the artery, it afcends in a direction to get behind the trachea, and it lies betwixt the trachea and æfophagus. It here fends off many branches to the back and membranous part of the trachea which pierce this pofterior part, to fupply the internal membrane. It gives alfo branches to the æfophagus and thyroid gland. The final diftribution of this nerve is to the larynx. It pierces betwixt the thyroid and cricoid cartilages, and feparates into many filaments, which terminate in the crico-arytenoideus, lateralis and pofticus, and thyro-arytenoideus, and in the membrane of the larynx. We have already mentioned the branch of communication betwixt the recurrent and internal laryngeal nerves *, and Sabatier defcribes a branch of the recurrent, which fometimes afcends and joins the fympathetic high in the neck.

Two cafes, mentioned by Galen, of fcrophulous tumours in the neck opened, where the confequence was lofs of voice, have tempted many anatomifts to inftitute experiments on the recurrent and internal laryngeal nerves †. Notwithftanding the deep fituation of thofe recurrent nerves, Galen fays, they were cut in thefe cafes, and he believed that the branch of communication betwixt the laryngeal and recurrent reftored the

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* There is a double communication betwixt thofe nerves ; in the firft place by this more fuperficial branch, and again by feveral internal and more minute branches.

† Martin, in the Edinburgh Effays, Profeffor Sue of Paris, Dr. Highton, in the Memoirs of the Medical Society of London ; Cruikfhanks, Profeffor Scarpa, Arnemann, &c.

voice

voice after fome time had elapfed. Both the internal laryngeal and recurrent nerves are neceffary to the formation of the voice. Experiments have been made upon them in dogs, and the refult is curious ; although the leffer changes of the ftrength, acutenefs, and modulation of the voice could not be well obferved in the lower animals. When the laryngeal nerve is cut, the voice is feeble but acute ; when the recurrent nerve is cut, there is a relaxation of thofe mufcles moving the artenoid cartilages which command the opening of the glottis, and in confequence the voice is flatter or graver, or more raucous.

The par vagum, after fending off the recurrent nerve, defcends by the fide of the trachea. Before it paffes behind the veffels and branch of the trachea going to the lungs, it fends minute branches which form the ANTERIOR PULMONIC PLEXUS *. This plexus is entangled in the connections of the pericardium, and is diffected with difficulty. The branches of this plexus throw themfelves round the pulmonic arteries and veins, and follow them into the lungs.

The par vagum, paffing on behind the root of the lungs, forms the POSTERIOR PULMONIC PLEXUS. From this alfo the nerves proceed in to the lungs, by attaching themfelves to the pulmonic arteries and veins, and broncheal arteries, and the branches of the trachea †.

The

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* I do not conceive that this plexus admits of any ufeful divifion, or requires any diftinction of name.

† *Nerves of the Lungs.*—Galen, Vefalius, and others, conceived that there were very few nerves fent to the lungs, and that thofe which were, went only to the membranes, and not to the fubftance of the lungs. They believed alfo that the difcharge of blood from the lungs and the exiftence of vomicæ without pain, while there was great pain in peri-pneumony, was a confirmation of this opinion. Fallopius corrected this idea, and fhewed that the bronchiæ were alfo attended through their courfe with nerves. . There often exifts vomicæ and effufions of blood in the lungs ; and Haller fays, the lungs can be lanced without the animal feeling pain, but ftill the bronchiæ are extremely fenfible.—Water accumulated in the interlobular cellular membrane, or the infarction of blood into it, gives no acute pain, but only a fenfe of weight and difficulty of breathing. It is an oppreffion in a great meafure depending upon the return of the
blood

The trunks of the nerve, continuing their courfe upon each fide of the æfophagus, unite and fplit into branches, and again unite fo as to form a netting upon the æfophagus ; thefe are the ANTERIOR and POSTERIOR PLEXUS GULÆ, or ÆSOPHAGEAL PLEXUS. The par vagum, thus attached to the æfophagus, pierces the diaphragm with it, the anterior plexus unites again into a confiderable trunk, is attached to the leffer arch of the ftomach. It ftretches even to the pylorus, and fends its branches to the upper fide of the ftomach and to the leffer omentum ; at the fame time it unites with the left hepatic plexus, fome of its branches terminate in the folar plexus, which furrounds the root of the cæliac artery. The pofterior æfophageal plexus, likewife uniting again into a confiderable cord when it has come into the abdomen, fends branches to encircle the cardiac orifice of the ftomach ; it branches alfo to the inferior fide and great arch of the ftomach ; it fends alfo branches to the fplenic plexus and folar ganglion.

Thus we fee that the par vagum has a moft appropriate name, and that it is nearly as extenfive in its connections as the fympathetic itfelf. It is diftributed " to the æfophagus, pharynx, and larynx ; to the thyroid gland, veffels of the neck and heart, to the lungs, liver and fpleen, ftomach, duodenum, and fometimes to the diaphragm." The recollection of this diftribution will explain to us many fympathies ; for example, the hyfterical affection of the throat when the ftomach is diftended with flatus ; the exciting of vomiting by tickling the throat ; the effect which vomiting has in diminifhing the fenfe of fuffocation ; that ftate of the ftomach

blood from the lungs, unchanged in confequence of the compreffion of the cells.—The fenfibility of the bronchiæ, and the exiftence of their nerves, appear in afthma ; and alfo from the pain excited by calculi, and from their irritability excited by recent ulceration, or when vomicæ are difcharged into them.

The connection betwixt the ftomach and bronchiæ, through the medium of the par vagum and pulmonic plexus, is evident from thofe afthmatic attacks which depend upon foulnefs in the ftomach.

which

which is found upon diffection to accompany hydrophobia, whether fpontaneous, or from the bite of a dog.

OF THE ACCESSORY NERVE; OR THIRD DIVISION OF THE EIGHTH PAIR OF NERVES.

THE fpinal àcceffory nerve of Willis is that which, taking its origins like the cervical nerves from the fpinal marrow, afcends through the fpine and foramen magnum of the occipital bone, and paffes again from the fcull like one of the nerves of the brain.   It paffes out with the par vagum, is attached·to it in its paffage, but again feparates from it when it has efcaped from the fcull.   Under the bafe of the cranium it is attached to the ninth pair alfo. Commonly this attachment is firm ; fometimes, it is by a fhort filament.   This parafitical nerve then paffes behind the internal jugular vein, and paffes obliquely downward and backward.   It then perforates the maftoid mufcle, and paffes in a direction acrofs the neck to the fhoulder.   While it pierces, it gives nerves to the maftoid mufcle ; and after piercing, it entangles its branches with thofe of the third and fourth cervical nerves. It then paffes under the trapezius mufcle, and is diftributed to it, where it is on the back of the neck and fhoulder.   From the diftribution of this nerve, fays a Frenchman, we difcover that the fhrug of the fhoulders is very natural ; and " pourquoi les grandes paffions de l'ame nous portent à gefticuler, pour ainfi dire, malgré nous *!"

OF THE NINTH PAIR, LINGUALIS MEDIUS; OR HYPOGLOSSUS.

AFTER paffing out from the fcull by the anterior condyloid foramen, the ninth nerve adheres to the eighth pair, by cellular filaments and the interchange of nerves. It receives alfo branches from the firft cervical nerve, or from the branch of union of the firft and fecond cervical nerves.   When diffecting in the neck, we find the

* Sabatier.

ninth

ninth nerve lying by the fide of the internal jugular vein under the ftyloid mufcles, and coming out from under the occipital branch of the internal carotid artery.

The nerve here divides, or it may rather be faid to give off that branch which is called the DESCENDENS NONI. The continued trunk of the nerve paffes before the external carotid artery, and forwards under the larger branches of veins in a direction tending towards the os hyoides. Here it turns upwards under the ftylo-hyoideus and digaftricus mufcles, and betwixt the ftylogloffus and hyo-gloffus. Where the nerve is near the os hyoides, and paffing under the ftylo-gloffus mufcle, it fends down a twig which paffes to the fore-part of the throat, and chiefly to the fterno-hyoideus and thyro-hyoideus.

The continued nerve is diftributed to the mufcles of the tongue and lower jaw, and glands under the jaw ; and it terminates by numerous filaments, which form a net-work amongft the mufcles of the tongue ; to which is united part of that branch of the fifth pair which goes to the tongue *.

The RAMUS DESCENDENS NONI paffes downward, and obliquely over the trunk of the carotid artery, and under the thyroid vein. In the fuperficial diffection of the mufcles of the neck, two flender twigs of nerves will be feen to come from the fide of the neck, and croffing the jugular vein, unite to this defcending branch. Thofe twigs come from the fecond and third cervical nerves † ; and a little ganglion or plexus is formed by their union with the defcendens noni. From this center are fent out many delicate and fuperficial nerves to the omo-hyoideus and fterno-thyroideus mufcles.

Thus we find that the ninth nerve has connections with the eighth pair of nerves, with the fpinal acceffory,

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* This has been called *plexus cerato-bafio-ftylo-gloffus* !

† In fome inftances thofe twigs are found to be derived from the firft origin of the phrenic nerve.

the

the fympathetic, the cervical, and phrenic nerves. When
this nerve is injured, the motion of the tongue is loft,
but the fenfe of tafte remains unimpaired. On the
contrary, when the branch of the fifth nerve going
to the tongue is hurt, the fenfe of tafte is loft,
while the mobility of the tongue remains *. , Columbus
knew a man who had no fenfe of tafte, and who ate in-
differently every thing prefented to him. When he
died, Columbus was curious to know the caufe of this,
and he found that he altogether wanted the guftatory
nerve or lingual branch of the inferior maxillary nerve.
Cafes detailed by profeffor Scarpa ftill further illuftrate
this fact. A woman, fubject to epileptic attacks in an
carly age, was feized in her pregnancy with an hemi-
plegia and lofs of fpeech. From this attack, by the
ufe of medicines, fhe recovered ; but in a future la-
bour the difeafe recurred. Now the cure was lefs com-
plete ; for, though fhe regained the ufe of her arms,
fhe never recovered the faculty of fpeech, or was only
capable of articulating with great diffonance the mono-
fyllables, affirming or denying. Upon making her exert
herfelf to fpeak, they obferved no motion in the tongue;
and, upon applying the hand under the jaw, they could
feel no motion in the mufcles of the tongue ; yet fhe
relifhed her food and drink, and had an acute fenfe of
tafte, and could fwallow eafily. He mentions another
cafe, where the patient was attacked with a fenfe of
weight at the root of the tongue, a difficulty of fpeak-
ing, and copious flow of faliva. In a fhort time he in-
tirely loft the power of articulating, but retained acutely
the fenfe of tafte †.

From the extenfive connection of this nerve, parti-
cularly with the eighth and fympathetic nerves, we fee
why tremors of the tongue and aphonia may be occa-
fioned by hyfteria, hypochondriafis, colics, or worms in
the inteftines ‡.

* Soemmerring de Cerebro & Nervis.
† Tabulæ Neurologicæ, Auctore Anton. Scarpa.
‡ J. F. Will. Bachmer Comment. de 9^{no} pare Nervorum.

OF

2

OF THE CERVICAL NERVES.

FIRST CERVICAL NERVE. TENTH PAIR OF THE SCULL. SUB-OCCIPITAL NERVE. This is the leaft of all the nerves of the fpine; it arifes by two roots from the medulla fpinalis. Some difference has been obferved in the manner in which thofe roots collect their filaments; and only the anterior root or fafciculus is defcribed by fome authors. The pofterior fafciculus is indeed the larger, and comes in a direction different from the general direction of the roots of the other cervical nerves. The roots of the fub-occipital nerve are connected with the fpinal acceffory nerve, but feldom form a ganglion with it; and frequently they form a union with the pofterior roots of the fecond cervical nerve. The fibres of the fub-occipital nerve paffing tranfverfely and a little obliquely upwards, go out under the vertebral artery, and betwixt it and the firft vertebra of the neck. The little trunk of the fub-occipital nerve, thus formed, and having efcaped from the fpine, rifes for a little way upwards, fwells into a kind of ganglion, and then divides into two branches.

The anterior of thefe branches is the fmaller. It paffes down upon the infide of the vertebral artery; its filaments unite with the hypogloffal nerve, or ninth pair, and with the fuperior cervical ganglion of the fympathetic, and with the firft branch of the fecond cervical nerve *. The larger and pofterior branch divides into eight twigs, which are chiefly diftributed to the mufcles moving the head—to the obliquus fuperior and inferior, the recti poftici and laterales, complexus, and fplenius. Some of thofe mufcular branches unite with that branch of the fecond cervical nerve which afcends upon the occiput.

* A very fmall nerve is defcribed by fome authors as paffing from the anterior divifion of this nerve, into the canal of the vertebral artery.

SECOND CERVICAL NERVE. This nerve, arifing by a double origin from the fpinal marrow, like the other nerves of the fpine, paffes betwixt the firft and fecond vertebræ. It is larger than the laft; and, after forming a little ganglion by the fide of the tranfverfe procefs of the firft vertebra, divides into two branches.

The SUPERIOR BRANCH fends up a confiderable divifion behind the projection of the tranfverfe procefs of the firft vertebra, to be united to the fub-occipital or firft cervical nerve. Several twigs pafs forward to unite with the fuperior cervical ganglion of the fympathetic nerve, and with fome of the more anterior branches of the third cervical nerve, and with the ninth and fpinal acceffory nerves. Befides thefe intricate connections, irregular branches of this nerve proceed to the fmall mufcles, moving the head and lying on the fore-part of the fpine. The *pofterior* branch of the fecond pair of cervical nerves is chiefly a mufcular nerve. It rifes up by the fide of the complexus, gives branches to that mufcle and to the fplenius, and communicates with the branches of the firft cervical. Its branches are alfo diftributed to the upper part of the trapezius mufcle, from which they extend along the integuments, covering the occiput even to the fummit of the head.

The THIRD CERVICAL NERVE, in the firft place, communicates with the fecond and fourth cervical nerves, with the fympathetic and lingual nerves, and fometimes fends down a twig to unite with the origin of the phrenic nerve from the fourth cervical nerve.

From the anterior divifion of the third cervical nerve, branches pafs to the fplenius and complexus, and trapezius, and upwards to the ear. We may obferve alfo a cutaneous nerve which accompanies the external jugular vein, viz. NERVUS SUPERFICIALIS COLLI; the diftribution of which is chiefly to the angle and margin of the lower jaw, while fome of its branches enter the parotid gland, and unite with the extremities of the portio dura and other facial nerves.

The SMALL POSTERIOR DIVISION of the nerve paffes
to

to the complexus, fpinalis cervicis, and multifidus fpinæ, while at the fame time it unites to the branches of the fecond cervical nerve.

The FOURTH CERVICAL NERVE, coming out from betwixt the third and fourth cervical vertebræ, divides into its anterior and pofterior branches like the other cervical nerves.

The firft goes to form, with the third and fifth cervical nerves, the PHRENIC NERVE. It fends alfo a branch to the fympathetic, to the integuments of the neck and fhoulder, and to the fupra and infra fpinatus mufcles. Thefe are called by Soemmerring SUPERCLAVICULARES ANTERIORES, MEDII, and POSTERIORES.

The great POSTERIOR DIVISION of the fourth cervical nerve, paffes to the mufcles of the fpine and fhoulder, in conjunction with the branches of the third cervical nerve.

FIFTH CERVICAL NERVE.—This nerve comes of courfe from betwixt the fourth and fifth vertebræ, and from betwixt the fcaleni mufcles. It divides alfo into two branches. The SUPERIOR of thefe paffes backwards to the mufcles of the back and fhoulder, and a branch formed by it; and the fixth paffes down under the fcapula and ferratus major. This fuperior divifion of the nerve fends up alfo two fmall twigs of communication with the fourth cervical nerve.

The INFERIOR DIVISION of the nerve fends down upon the fide of the neck a confiderable branch to the formation of the phrenic nerve. It communicates with the root of the fixth nerve, and fends mufcular branches backward.

The SIXTH CERVICAL NERVE.—The mufcular branches of this nerve are large, and extenfive in their courfe. They pafs into the levator fcapulæ, extend under the trapezius, and unite with the extreme branches of the fpinal acceffory nerve. They are prolonged to the latiffimus dorfi and ferratus magnus. Branches alfo extend down behind the clavicle, and under the pectoral mufcle.

Befides

Befides thefe branches, this nerve communicates with the fifth, and gives out an origin to the phrenic nerve; and laftly, uniting to the feventh, it paffes into the axillary plexus.

The SEVENTH CERVICAL NERVE.—This nerve goes almoft entirely to form the axillary plexus. There is a communicating nerve from the laft to this, and from that communicating branch generally there paffes off a filament to the phrenic nerve; and from the very root of the nerve there paffes off a branch to the lower cervical ganglion of the fympathetic. Irregular twigs alfo defcend from this nerve under the clavicle to the pectoralis minor and major.

The EIGHTH CERVICAL NERVE.—The greater part of this nerve paffes to the axillary plexus. It fends fmall branches to the lower cervical ganglion of the fympathetic, and to the mufcles of the breaft; which laft defcend behind the clavicle.

RECAPITULATION OF THE DISTRIBUTION OF THE CERVICAL NERVES.

UPON reviewing the defcription of thefe nerves, we find that the general tendency of their branches is backwards over the fide of the neck, to the mufcles moving the head and fhoulders. We find alfo that they are connected in a very intricate manner with the moft important nerves of the cranium. High in the neck and under the jaw, they are connected with the portio dura, with the fifth pair, with the eighth and ninth pairs, and with the fympathetic. Towards the middle of the neck they are ftill throwing their connecting branches to the defcendens noni, and fympathetic, and eighth pair. The lower cervical nerves again are ftill fupporting their connections with the lower ganglion of the fympathetic.

Further, we find the phrenic nerve derived (moft frequently) from the third and fourth, and branch of communication betwixt the fourth and fifth. The AXIL-

LARY PLEXUS is formed by the fifth, fixth, feventh, and eighth cervical nerves, and firft of the back.

OF THE DORSAL NERVES.

THERE are twelve dorfal nerves. Thefe, as we have defcribed, are formed by two fafciculi of fibres; one from the fore, and the other from the back part of the fpinal marrow. Thefe filaments run for fome way fuperficially in the length of the fpinal marrow before they pierce the dura mater. They pierce it feparately; the pofterior branch firft forms a ganglion, and then the two fafciculi are united. They are now betwixt the heads of the ribs. We muft here recollect, that the trunk of the fympathetic nerve, which paffes along the cavity of the thorax, runs down behind the pleura, and paffes before the heads of the ribs through all the length of the back. It receives, as it paffes, the interftices of the feveral ribs, at each interval, a communicating nerve from the fpinal marrow; a branch from the intercoftal or dorfal nerves.

Thofe communications are fent in the following manner: the proper dorfal, or intercoftal nerve fends its greater branch forwards betwixt the ribs; fome leffer branches pierce backwards to the mufcles of the back; oppofite to this there goes out from each nerve the firft branch of union with the fympathetic, and this union forms a firm ganglion. Sometimes there run out in this direction two fhort branches from the fpinal nerve, to unite with the ganglion of the fympathetic; but more commonly there paffes in a retrograde direction from the intercoftal nerve, where it is about to take its courfe between the ribs, another branch of communication which joins the fympathetic. Sometimes the dorfal or intercoftal nerves fend off three communicating branches to the fympathetic.

The intercoftal nerves pafs on betwixt the ribs, in company with the intercoftal arteries, and reach even to the fternum. In this courfe they fupply the intercoftal mufcles and triangularis fterni, while they are at the fame time fending out branches, which, piercing the

I I 3   intercoftal

intercoſtal muſcles and faſcia of the thorax, are diſtri-
buted to the muſcles on the outſide of the cheſt.——
Thoſe branches which we mentioned as paſſing betwixt
the heads of the ribs, and which are ſent off immedi-
ately upon the trunk eſcaping from the vertebral open-
ing, ſupply the multifidus ſpinæ and levatores coſtarum,
and other extenſor muſcles of the ſpine. Slips pro-
ceeding from the ſecond, third, fourth, and fifth inter-
coſtal nerves, ſend branches to the pectoral muſcles, the
ſerratus anticus, and ſerratus poſticus ſuperior, trapezi-
us, and rhomboides. The ſixth, and all the lower nerves
of the back, ſend branches from betwixt the ribs to the
latiſſimus dorfi, ſerratus inferior, and abdominal muſ-
cles. The eleventh and twelfth are diſtributed to the
diaphragm, quadratus lumborum, pſoas magnus, and
iliacus internus.

LUMBAR NERVES.

THE lumbar nerves are five in number. The firſt
comes out under the firſt lumbar vertebra, and the
others in ſucceſſion. Their trunks are covered by the
pſoas magnus. They paſs very obliquely downward,
and the three loweſt are of remarkable ſize.

In the general diſtribution, we may firſt remark the
poſterior branches, which go backwards to the muſcles
which ſupport and extend the ſpine. Again, the ante-
rior branches ; which give, 1ſt, additional branches to
the ſympathetic nerve as it paſſes over the vertebræ of
the loins, and by which it is ſupported and reinforced till
it terminates in the pelvis ; 2dly, they have frequent
connection with each other, and with the laſt nerve of
the back, and firſt of the ſacrum ; 3dly, they ſend out
branches, delicate but of great extent, to the muſcles
of the loins and back, and to the abdominal muſcles
and integuments of the groin and ſcrotum ; 4thly, the
principal anterior branches of the lumbar nerves paſs
down to form (along with the great nerves of the ſa-
crum) the anterior crural nerve, the obturator, and the
great iſchiatic nerve.

SACRAL NERVES.

THE nerves which come out from the extremity of the medulla fpinalis, or cauda equina, through the facrum, are in general five in number. Sometimes there is one more or lefs. The firft divifion of each facral nerve is into thofe branches which pafs out by the pofterior foramina of the facrum, and thofe which, by the anterior foramina, come into the pelvis. The pofterior branches are very fmall, and pafs to the mufcles fupporting the fpine; while the anterior ones are particularly large, efpecially the firft and fecond, which, with the loweft of the loins, go to form the largeft nerve of the body, the ifchiatic nerve.

It is difficult to recollect the diftribution of the feveral branches of the lumbar and facral nerves, when taken thus together; but when we deliver the defcription of the nerves of the thigh and leg, we count them, and hold them in remembrance with comparative eafe. At prefent we are beft prepared to follow the fympathetic nerve in its courfe.

OF THE GREAT SYMPATHETIC NERVE, OR INTER-COSTAL NERVE.

NOTWITHSTANDING the idea of this nerve which I have endeavoured to convey, I conceive that we muft ftill continue to fpeak of its origins in the ufual way, for the fake of fimplicity and arrangement.

The fympathetic nerve is in general confidered as originally derived from the fixth pair; or, we may fay, it takes its origin from the fixth, where it paffes by the fide of the carotid artery, and from the vidian branch of the fifth pair. It appears without the fcull, fometimes behind and fometimes before the carotid artery, and fometimes it is double in its exit from the bafe of the fcull. Almoft immediately after it has efcaped from the fcull, it forms its firft ganglion; which is very large and
remarkable,

remarkable, and has the name of the SUPERIOR CERVI-
CAL GANGLION of the fympathetic nerve. It is of a
foft confiftence and reddifh colour, and it extends from
the fcull to the tranfverfe procefs of the third vertebra.
It gradually tapers downwards until it becomes a very
flender nerve. This ganglion has much variety of
fhape in different fubjects, and may be faid in general
to receive twigs of nerves upon the back part ; whilft
it gives them out upon the fore part.

The fuperior cervicle ganglion of the fympathetic
nerve receives nerves from the fecond, third, and fourth
cervical nerves, and even fometimes from the root of
the phrenic nerve. It has alfo connections with the
hypo-gloffal, par vagum, and gloffo-pharyngeal nerves.
It fends out branches to unite with the gloffo-pharyngeal,
and which follow that nerve in its diftribution to the
tongue and pharynx. Many of its branches furround-
ing the carotid artery form connections with the internal
and external laryngeal nerves, and proceed in mefhes,
or form plexus along with the branches of the artery.
Thefe may be followed to great minutenefs.

To be more particular in the defcription of thefe an-
terior branches of the fympathetic nerve, they are
called the NERVI MOLLES, or NERVI VASORUM. They
are nerves peculiarly foft, with a greater proportion of
cellular membrane; they fpread in net-works along the
arteries, and form frequent connections by little knots
like fmall ganglions. Claffed with thefe nervi vaforum,
are branches which pafs forward from the upper gang-
lion of the fympathetic, to unite with filaments from
the internal laryngeal nerve of the par vagum, and which
form the external laryngeal nerve. It is remarked, that
none of thefe branches of the fympathetic nerve are dif-
tributed to the larynx and pharynx without being ming-
led and affociated with the gloffo-pharyngeal nerve, or
with the pharyngeal branch of the par vagum *. Of
the nervi molles, fome form a plexus upon the internal

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* Searpa

carotid

carotid artery. Thefe are extremely foft and pulpy, and are united with branches which defcend from the gloffo-pharyngeal nerve. A net-work is alfo formed, which covers the beginning of the external carotid artery. From this, as from a center, branches are fent out with the arteries to the neck, and face, and glands under the jaw; and thefe laft, with a mefh which paffes up upon the temporal artery, unite with the portio dura of the feventh pair.

It has been often obferved, that the branches of the carotid artery have a peculiar provifion of nerves, and that thefe nerves are more numerous and minutely dif-tributed than in any other part of the body. There are indeed no nerves in any part of the body which have fo extenfive and intricate connections with important nerves as the cutaneous nerves of the face and neck.

This diftribution of the nerves is, I conceive, a pro-vifion for that power poffeffed by the imagination, or rather that uncontrolable connection which exifts betwixt the feelings and the action of the veffels in blufhing.

The loweft of the nervi vaforum or molles, fent off from the fuperior ganglion of the fympathetic nerve, de-fcends in the courfe of the trunk of the nerve, and forms, with other branches, the fuperior cardiac nerve.

This nerve, generally called NERVUS CORDIS SUPER-FICIALIS, paffing down in the direction of the trunk of the fympathetic nerve, and near the longus colli mufcle, is for fome length a very flender branch; but in its courfe it receives two, three, or four additional twigs from the fympathetic, and branches which come under the carotid artery from the pharyngeal nerves, or nervi molles. When this fuperior cardiac nerve is within an inch or two of the fubclavian artery, branches of union pafs betwixt it and the recurrent nerve of the par vagum; and branches of the nerves paffing to the heart from the lower cervical ganglion, alfo join it. It then, attaching itfelf to the invefting membranes and fheaths of the ca-rotid and fubclavian arteries, forms with others a plexus of nerves, which run along the great veffels to the heart.

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The continued trunk of the fympathetic, where it emerges from the fuperior cervical ganglion, is extremely fmall. It defcends behind the carotid artery, and lies near to the fpine. When oppofite to the fifth and fixth cervical vertebræ, the inferior cervical ganglion of the fympathetic is formed. In this courfe, twigs of communication pafs betwixt it and the cervical nerves, or join it with the beginning of the phrenic nerve.

But not unfrequently there are three cervical ganglions formed by the fympathetic nerve; the fuperior, middle, and inferior ganglions : or it happens that we find the fympathetic nerve fplit into two branches in the neck; one of which forms the middle, and the other the lower ganglion.

There are received by the MIDDLE CERVICAL GANG-LION, or, THYROID GANGLION, branches of nerves from the third, fourth, fifth, and fixth cervical nerves, and alfo fometimes from the phrenic nerve. The ganglion is by no means conftantly found, and it is irregular in its fize and fhape. When large, and in what may be confidered as its more perfect ftate, it gives off fome confiderable branches. Of thefe, part unite with the fuperior cardiac nerve already mentioned ; others from the great or deep cardiac nerve, while leffer ones play round the fubclavian artery, and unite with the lower cervical ganglion, or the upper thoracic ganglion.

The deeper cardiac branch of the fympathetic, fplitting and again uniting fo as to form rings, runs outwards, attached to the arteria innominata and arch of the aorta, to the heart. In this courfe, while it paffes before the trachea, it forms connections with the recurrent branch and trunk of the par vagum. Under the arch of the aorta, we find this branch concentrated to form the GANGLION CARDIACUM of Wrifberg, or GANGLION MOLLE et PELLUCIDUM of Scarpa. This ganglion is like a mere enlargement or fwelling of the nerve. From this, four or five branches may be enumerated ; 1ft, A branch paffing behind the pulmonary artery to the back of the heart, and following the left coronary artery ; 2dly, A fmall divifion to the anterior
pulmonary

pulmonary plexus of the par vagum; 3dly, A pretty confiderable branch which, paffing behind the aorta, and betwixt it and the pulmonary artery, is diftributed with the right coronary artery to the anterior part of the heart. On the left fide of the neck, the fympathetic, receiving on the one fide branches from the cervical nerves, and on the other giving off branches, which defcend behind the carotid artery to the heart, (viz. the fuperior cardiac,) often fplits before it forms the middle or thyroid ganglion, and fometimes throws its branches over the thyroid artery, and the ganglion lies upon that artery. Again, from the ganglion there defcend two feries of numerous leffer filaments, which form methes upon the thyroid and fubclavian arteries to the heart. Others proceed downward behind the arteries to the lower cervical ganglion. Thofe branches which defcend upon the arteries, intangle the roots of the thyroid, tranfverfalis cervicis, and internal mammary arteries, in their plexus; thefe uniting, follow the fubclavian artery, and form again a plexus upon the arch of the aorta. This is joined by branches from the par vagum and recurrent. The principal branches of this plexus terminate in the cardiac ganglion under the arch of the aorta *.

The LOWER CERVICAL GANGLION of the fympathetic nerve is placed upon the limits betwixt the neck and thorax upon the head of the firft rib, and by the fide of the mufculus longus colli; and it is in part covered by the root of the vertebral artery. The ganglion is of an irregular cuthion-like fhape. It lies clofe to the cervical nerves which go to the brachial plexus, and it receives branches from them †. Branches alfo pafs from this ganglion to the par vagum and recurrent, and alfo pafs

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* This defcription of the fympathetic nerve on the left fide follows the more ufual diftribution, but is not peculiar to the left fide.

† And even it receives fometimes from the fifth and fixth, more rarely the feventh and eighth, from the firft and fecond of the back; and laftly, from the phrenic nerve.—Sometimes thefe connections are wanting.

on to the cardiac and pulmonic plexus. That nerve, which muſt be conſidered as the continued ſympathetic, throws a ring round the root of the vertebral artery, and ſending out branches upon the ſubclavian, terminates in the firſt dorſal or thoracic ganglion.

THE SUPERIOR THORACIC GANGLION.

THIS ganglion ſurpaſſes the other thoracic ganglions in ſize. It is, indeed, frequently compoſed of many branches of the nerve in the neck, coming both before and behind the ſubclavian artery. It receives alſo nerves from the three or four loweſt cervical nerves, and firſt dorſal nerve. It is of a very irregular figure, or rather it varies exceedingly in its ſhape; ſo that by various anatomiſts it is deſcribed as round, oval, triangular, quadrangular, cylindrical !—Filaments proceed from this ganglion into the canal of the vertebral artery, and to the cellular coat of the ſubclavian artery, and to the cardiac plexus, and alſo to the pulmonic plexus ; or to ſupply the poſterior ſurface of the lungs.

SYMPATHETIC NERVE IN THE THORAX.

THE ſympathetic nerve (as we have explained in deſcribing the dorſal nerves) through all its courſe in the thorax, has additional branches from the dorſal or intercoſtal nerves. It forms alſo, while it is lying on the ſide of the vertebræ, a diviſion in the thorax, which it will be important to recollect. This nerve is ſent more forwards upon the body of the vertebræ, and paſſes into the abdomen betwixt the crura of the diaphragm ; while the trunk of the ſympathetic continues its courſe by the heads of the ribs, paſſes under the ligamentum arcuatum, and downwards upon the lumbar vertebræ.

The SPLANCHNIC NERVE, then, is this anterior branch of the ſympathetic in the thorax. It is the great nerve of the viſcera of the abdomen. It generally has two or four roots from the trunk of the ſympathetic nerve, where it is oppoſite to the ſixth, ſeventh, and
                                        eighth

eighth intercoftal nerves. It is feen lying under the pleura, and paffing obliquely over the bodies of the lumbar vertebræ, from the feventh to the tenth. It then paffes betwixt the crura of the diaphragm, enters the abdomen, and forms the great femi-lunar ganglion.

One or more branches are fent forward from the fympathetic, commonly from the ganglions, oppofite to the interftice betwixt the ninth and tenth, or tenth and eleventh ribs. Thefe alfo pafs the diaphragm, and unite with the femi-lunar ganglion. There is, however, a confiderable variety to be obferved both in the origins of the fplanchnic nerve, and in the number of thefe fubfidiary branches. A larger branch, going off betwixt the tenth and eleventh ribs, is fo common, that it has the name of SPLANCHNICUS MINOR, or ACCESSORIUS. This nerve as frequently terminates in the renal plexus, as in the femi-lunar ganglion; or fometimes it fends branches to both.

CÆLIAC GANGLION AND PLEXUS.

THE ganglion which is called the femilunar ganglion, has no regular fhape—and leaft of all when it is fully diffected. It is formed by the fplanchnic nerve, and by branches which come from the lumbar nerves. It lies by the fide of the cæliac artery, and confifts of many leffer ganglions, (fometimes to the number of eleven or twelve,) matted together into a glandular-like fhape.

The femilunar ganglions of the fplanchnic nerves lye on each fide of the root of the cæliac artery; their connection with each other is frequent and intricate; fo that they throw a mefh of nerves round the root and branches of this artery, which is the great fource of veffels to the ftomach, liver, and fpleen.— This plexus, formed by the femilunar ganglions round the cæliac artery, is the folar or cæliac plexus.

CÆLIAC PLEXUS.

THE cæliac plexus is the great fource of nerves to the higher vifcera of the abdomen. The fplanchnic nerves are the great, but not the only nerves which form this plexus. The par vagum fends branches down from the ftomach which join it; and even the phrenic nerve, which is the nerve of the diaphragm, fends down twigs to unite to the branches of the fplanchnic and par vagum. We fhall find alfo fmall nerves which come from the feat of the kidney, and which are derived from the fuperior lumbar nerves.—Thefe pafs acrofs the crura of the diaphragm, and enter into the cæliac plexus. —In purfuing the nerves of the vifcera further, we have it no longer in our power to follow individual branches, but have rather to mark the courfe, and enumerate the various fources of the plexus, and net-work of nerves which follow the great veffels.

From the cæliac plexus, there pafs out from others, 1. Nerves which accompany the phrenic arteries upon the lower furface of the diaphragm. 2. Nerves to the liver:— and of thefe there are two plexus, the right and left hepatic plexus; one paffes along the vena portæ, biliary ducts, and right hepatic artery, to the right fide of the liver, the gall bladder and ducts; this of courfe is the RIGHT HEPATIC PLEXUS: the LEFT HEPATIC PLEXUS paffes along the left hepatic artery; and this has connection with the cardiac nerves, branches of the par vagum. 3. That plexus, which runs upon the leffer curve of the ftomach, while it is formed in a great meafure by the par vagum, has alfo connection with the folar or cæliac plexus. 4. The plexus of nerves which pafs to the lower orifice of the ftomach and duodenum is chiefly a divifion of the right hepatic plexus. Thefe nerves, to the liver, ftomach, and duodenum, are attached to the branches of the cæliac artery. Along the great fplenic artery, which is alfo derived from the cæliac artery, there paffes out a plexus of nerves to the fpleen. From this fplenic plexus there pafs nerves to the great omentum;
and

and they even unite with thofe paffing out upon the duodenum, and which attach themfelves to the right epiploic artery, and take a courfe upon the great curvature of the ftomach.

Thus the folar or cæliac plexus is a great central net-work of nerves, which pafs out in divifions to the liver, fpleen, pancreas, ftomach, duodenum, and omentum.

SUPERIOR MESENTERIC PLEXUS.

THE place and connections of the fuperior mefenteric plexus is at once known, when it is confidered that it is formed upon the root of the fuperior mefenteric artery.—It is formed by the cæliac plexus being continued down upon the aorta fo as to involve the root of the mefenteric artery, and by nerves coming over the fide of the vertebræ of the loins from the lumbar nerves. This plexus fpreads betwixt the membranes of the mefentery, and extends upon the branches of the artery, and of courfe is diftributed to the fmall inteftines and part of the colon. It confequently fupplies the mefenteric glands, and fends nerves alfo to the pancreas, that join thofe which it receives from the fplenic plexus.

INFERIOR MESENTERIC PLEXUS.

THE fame mefh of nerves, being continued down upon the face of the aorta, furround the lower mefenteric artery, and follow its branches. This is the lower mefenteric plexus, or mefocolic plexus; and it is formed in a great meafure from the branches of the continued trunk of the fympathetic nerve.—As this plexus fpreads upon the branches of the lower mefenteric artery, it paffes to the left fide of the inteftinum, colon and rectum — while the lower mefenteric plexus is continued from the upper one. On the fide of the lumbar vertebræ it is continuous with the renal and fpermatic plexus; and towards the pelvis, with the hypogaftric plexus.

Before

Before confidering the other leffer plexus of nerves in the abdomen, it is neceffary to follow the continued trunk of the fympathetic nerve which we had defcribed as following clofely the lateral part of the dorfal and lumbar vertebræ, whilft the fplanchnic nerves pafs obliquely over them to the vifcera of the upper part of the belly.

The CONTINUED TRUNK of the SYMPATHETIC NERVE, after it has given off the fplanchnic nerve in the thorax, fends feveral fmall nerves forward over the vertebræ to the mediaftinum and fheath of the aorta. It then paffes the diaphragm, keeping clofe to the tranfverfe procefs of the vertebræ. When, however, it comes lower upon the lumbar vertebræ, it lies more upon the fide of their bodies, and the connections with the lumbar nerves are by fmall and numerous twigs which ftretch over the fide of the vertebræ. In this courfe, it is giving off upon the fore part numerous irregular twigs to the feveral plexus which have been defcribed. Where it lies under the veffels which pafs to the kidney, it fends up fome branches to the renal plexus.

The renal plexus, however, is not entirely formed of thefe branches of the continued fympathetic, but is rather a continuation from the cæliac and fuperior mefenteric plexus ; while the leffer fplanchnic nerve, which was fent off in the thorax, alfo terminates in it. This plexus is thrown over the veffels of the kidney, and forms feveral little ganglions.

From the renal plexus defcends the SPERMATIC PLEXUS with the veffels to the tefticle. This plexus of nerves in woman follows the fpermatic artery in its diftribution to the ovaria and uterus.

In paffing down upon the loins, the fympathetic nerve forms five or fix ganglions with the branches from the lumbar nerves. Thefe are oblong, angular, ftellated— irregular in their form, as in their number, fituation, and fize, as the twigs which, by their union with the fympathetic, form them. Betwixt thefe ganglions or connections with the lumbar nerves, the fympathetic is not always one nerve, but is fometimes fplit into feveral

fmaller

fmaller nerves, which unite again. From the fympa-
thetic nerves of either fide we have to obferve frequent
interchange of branches, which fometimes attach them-
felves to the lumbar nerves, fometimes creep under the
aòrta, or unite to the plexus covering the face of the
aorta.——There are feveral little ganglions formed by
thefe nerves upon the face of the lumbar vertebræ : they
have the name of ganglia accefforia.

Before the fympathetic nerve defcends into the pel-
vis, it has become extremely delicate. In many fubjeĉts
it feems to terminate in the laft lumbar, or firft facral
nerve ; but, upon more minute diffeĉtion, leffer branches
will be found to defcend amongft the loofe cellular
fubflance of the pelvis.——When regular, or perhaps
we may fay with truth when regularly and fully dif-
feĉted, the fympathetic nerves of each fide are feen to
defcend upon the fore-part of the facrum, and form
conneĉtions with the facral nerves fimilar to thofe with
the dorfal nerves.——As they defcend, they of courfe ap-
proach, and finally, unite in an acute point on the os
coccigis. At the points of union of thefe extreme branches
of the fympathetic nerves with the branches of the
facral nerves, fmall ganglions are formed ; and there
pafs out branches from them, which cover the interme-
diate furface of the facrum with an extenfive plexus.
The ultimate ganglion, formed by the union of the
two fympathetic nerves, is the *coccygeal ganglion*, and
from it there pafs three or four nerves to the extremity
of the reĉtum.

HYPOGASTRIC PLEXUS.

This is a plexus which lies on the fide of the pelvis,
and involves the hypogaftric artery. It confifts of the
nerves paffing to the parts contained in the pelvis ; which
do not, however, pafs in diftinĉt branches, but like
thofe of the abdomen, are formed into minute inter-
woven net-work. The hypogaftric plexus takes no de-
terminate origin, but is continuous with, or formed by,
the extreme branches of the fympathetic nerves, the ex-

tremity of the fpermatic plexus, the facral nerves, (and
particularly the third facral nerve,) and by the branches
of the acceffory ganglions on the facrum.

OF THE PHRENIC NERVE *.

THE phrenic or diaphragmatic nerve arifes from the
cervical nerves, paffes obliquely down the neck, enters
the thorax, and is diftributed to the diaphragm.—This
nerve has much variety in its derivation. It comes
chiefly from the third cervical nerve, deriving alfo fome
twigs from the fourth and fecond. But fometimes it
takes an origin very high in the neck, from the par
vagum or ninth nerve ; and even the fuperior cervical
ganglion of the fympathetic is defcribed by fome as fur-
nifhing a root.—Lower in the neck it will be found in
fome fubjects to derive very fmall additional twigs from
the fifth or fixth cervical nerves, or lower ganglion of
the fympathetic.

The phrenic nerve, thus formed, defcends into the
thorax betwixt the fubclavian artery and vein. In the
cheft it proceeds downward and forward, attached to
the mediaftinum, and before the root of the lungs †. It
takes its courfe upon the outfide of the pericardium, and
from the pericardium flips off to the furface of the dia-
phragm. From the pofition of the heart, the left phrenic

* E. Kruger de Nervo Phrenico. Sandefort Thefaur. Vol. III.
† Ludwig. Martin, in the Edinburgh Effays, and others, explain
the action of the diaphragm upon the fuppofition of the mechanical
preffure of the lungs upon the phrenic nerve. It is a piece of doc-
trine inconfiftent with knowledge of the general laws of the œcono-
my. It is repugnant to comparative anatomy, and it is evident that
the foft and elaftic diftention of the lungs could not comprefs the
firm nerve. Moreover, the lungs, when diftended, do not prefs upon
the mediaftinum, for it is the dilation of the thorax which caufes the
lungs to inhale the atmofpheric air. See *Wrifberg de Nervo Phrenico.*
Sander. Thef. vol. ii. p. 260. It is betwixt the heart and mufcles
of refpiration that the ftrict relation and fympathy exifts. When
in turning the child in utero, and when the cord has been preffed, I
have felt the ftrong convulfive *fetches* of the mufcles of refpiration
endeavouring, by the play of the lungs, to compenfate for the lofs of
the placenta.

                                                    nerve

nerve differs a little in its courfe from the right; and it paffes over the pericardium, covering the apex of the heart. The phrenic nerve of the right fide, befides fupplying the diaphragm, fends down through the diaphragm (to the right fide of the vena cava) the ramus anaftamoticus. This communicates with the femilunar ganglion of the fympathetic, or with the divifion of the folar or cæliac plexus which paffes along the phrenic arteries. From the phrenic artery of the left fide, there pafs down with the œfophagus fmall nerves which appearing in the abdomen, unite with the cæliac ganglion, or fome of its divifions; and both phrenic nerves will be found by fome minute branches to unite to the par vagum.

Thefe, however, are but minute branches. The great deftination of the phrenic nerve is to the diaphragm. The branches ftrike out from the diaphragm like roots from a centre; they pafs fome way only covered by the pleura, and then pierce into the fubftance of the mufcle. There are innumerable experiments upon living animals, which fhew the connection of this nerve with the action of the diaphragm. When the nerve is ftimulated, the diaphragm is excited to contraction; when cut, preffed, or tied, it becomes relaxed and inactive, and there is difficulty of refpiration; when the fpinal marrow is injured low in the vertebræ of the neck, or in the vertebræ of the back the external mufcles of refpiration ceafe to act, but the diaphragm ftill continues its function; and in this cafe, as obferved by Mr. Hunter, the patient lives for fome days, breathing by the diaphragm. If the phrenic nerves be divided in a living animal, the diaphragm ceafes to act, and the abdominal mufcles lofe their opponent mufcles, and remain as in expiration; but ftill the refpiration is continued by the motion of the ribs. If after this the fpine be divided, the motion of the lungs ceafes entirely, and the animal dies fuddenly.—The injury of the fpinal marrow above the origin of the phrenic nerves, is of courfe fuddenly fatal, becaufe it deftroys at once the function of the diaphragm, and mufcles moving the cheft. From the connection of the phrenic nerve with

the

the par vagum, we may explain the fympathy betwixt the trachea and the diaphragm, how the irritation of the trachea occafions coughing and the convulfive action of the diaphragm; in the fame manner in the affection of the ftomach, fingultus, from the fudden action of the diaphragm and abdominal mufcles, (which ufually alternate in their action,) may be explained. Again, a connection of nerves might be followed from the origins of the phrenic to the fympathetic nerve, and branches of the fifth pair to the nofe : which accounts for that fympathy of action which occafions fneezing from irritation of the membrane of the nofe.

NEVES OF THE ARM; AXILLARY, OR BRACHIAL PLEXUS.

THE nerves which proceed from the fpine, and go to fupply the arm, are formed into an intricate plexus before they divide into the feveral nerves of the arm.

This brachial, or axillary plexus, is formed of five of the fpinal nerves; viz. the fifth, fixth, feventh, and eighth cervical nerves *, and the firft dorfal nerve. The higheft of thefe nerves proceed from betwixt the fourth and fifth cervical vertebræ; the laft from betwixt the firft and fecond dorfal vertebræ. They pafs out betwixt the middle and anterior divifion of the fcaleni ; and even while covered by thefe mufcles, and before they have proceeded far from their foramina, the laft nerve of the neck and firft of the back unite †.—The plexus extends from above the clavicle to the edge of the tendon of the latiffimus dorfi. It allows of no natural divifion ‡. The axillary nerve paffes for fome way clofe

under

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* This is of courfe counting the fub-occipital as the firft cervical nerve.

† Before the nerves which form the plexus intermix their filaments, or are connected together, they fend off fmall branches to the fcaleni mufcles, to the mufcles of the fpine, and to the levator fcapulæ.—The branches which they give to the fympathetic nerve, we have already noticed.

‡ I mean that it admits of no divifion ufeful in the arrangement of

the

under it, and then perforates betwixt the divifions which form the radial nerve.

From the axillary plexus proceed thefe nerves :
1. The thoracic nerves.
2. The fupra and infra fcapular nerves.
3. The circumflex, or articular nerve.
4. The perforans Cafferii, or external cutaneous nerve.
5. The radial nerve.
6. The ulnar nerve.
7. The mufcular fpiral nerve.
8. The internal cutaneous nerves.

1. The THORACIC NERVES. Although the nerves which fupply the mufcles of the cheft are derived from the intercoftal nerves, as we have feen, yet there alfo pafs off branches from the axillary plexus to the great and little pectoral mufcles, to the latiffimus dorfi, to the fkin and mammæ. Thefe thoracic branches proceed from the upper divifion of the plexus, or that which gives out the external cutaneous, and one of the roots of the radial nerve.

2. The SUPRA-SCAPULAR NERVE comes off from the upper edge of the plexus, and is the higheft of the branches. It runs towards the root of the coracoid pro- cefs, it paffes through the notch of the fcapula, and goes to fupply the fupra and infra fpinatus mufcles, the teres minor, and the fub-fcapularis.

The SUB-SCAPULAR NERVES come out from the pof- terior part of the plexus along with the articular nerve. They are attached to the fub-fcapular mufcle, they turn round the flefhy edge of the mufcle, and infinuate their branches betwixt the tendon of the latiffimus dorfi and the teres major.

the demonftration. See Monro's Nervous Syftem, and the Latin work of Anton. Scarpa. Scarpa defcribes the connection of fila- ments betwixt the ulnar and radial nerve at their feparation from the great plexus, *Plexus brachialis minor.* Vide tab. ii. fig. ii. h.

3. The

3. The CIRCUMFLEX, or ARTICULAR NERVE, or AXILLARIS, lies very deep. It comes from the back part of the plexus, paffes behind the neck of the humerus, and above the tendon of the latiffimus dorfi, and teres major. One of its branches we trace into the teres major, while another paffes round the bone, and is diftributed to the under furface of the deltoid mufcle, the joint, and the cellular membrane.

4. PERFORANS CASSERII, or the EXTERNAL CUTANEOUS NERVE. This nerve paffes through the coraco-brachialis mufcle before the os humeri, to gain the outfide of the arm. From its perforating this mufcle, and being defcribed by Cafferius, it is called the nervus perforans Cafferii. Before paffing through the coracobrachialis mufcle, it fends down a branch of communication with the radial nerve; and in many fubjects it will be found to be like a branch from one of the origins of the radial nerve. Where the nervus perforans lies betwixt the brachialis internus mufcle and biceps, (and, of courfe, after it has perforated the coraco-brachialis mufcle), a branch or two are fent up to the heads of the biceps mufcle; another branch turns inward to the belly of that mufcle; and, finally, twigs pafs inward to the cellular membrane, which involves the brachial artery.

The continued nerve paffes obliquely acrofs the arm, and under the biceps. When approaching the outfide of the arm, it divides into three fmall branches; one to the integuments which are upon the fupinator longus, another to the integuments on the infide of the forearm, and a third, which continues its courfe along the edge of the fupinator longus to the wrift. Of this prolonged branch of the perforans Cafferii, a minute twig is loft on the ligament of the wrift, another paffes to the ball of the thumb, and a third goes round to the integuments of the back of the thumb.

5. The RADIAL NERVE. This nerve is formed by thofe divifions of the plexus which furround the brachial artery, and fometimes by a divifion of the perforans Cafferii. It takes its courfe by the fide of the

brachial

brachial artery, and gives off no branches until it has funk under the aponeurotic expanfion of the biceps mufcle.

When the radial nerve has come to the bend of the arm, it gives off three branches. The firft belongs to the pronator teres, flexor radialis, palmaris longus, and flexor digitorum ; a fecond paffes to the pronator teres ; a third to the deep mufcles of the fore-arm, to the flexors of the thumb particularly, and alfo to the pronator quadratus mufcle. The radial nerve, continuing its courfe down the fore-arm betwixt the flexor fublimis and profundus digitorum, fends off other branches to thofe mufcles. Before paffing under the ligament of the wrift, it gives out a branch which emerges from the tendons, and paffes to the integuments, fhort flexor, and abductor mufcles of the thumb.

The trunk of the radial nerve paffes with the tendons of the flexor mufcles of the fingers under the ligament of the wrift. In the palm of the hand it divides into five branches ;—the firft paffes to the abductor and flexor pollicis brevis ; a fecond goes to the adductor pollicis, and fide of the thumb next the fore-finger ; the third paffes to the fore-finger, and to the lumbricalis mufcle ; the fourth to the fide of the fore and middle fingers ; and the fifth to the fides of the middle and little finger. All thefe nerves, while in the palm of the hand, fend off branches to the lumbricales mufcles.

6. The ULNAR NERVE comes off from the lower part of the plexus in union with the internal cutaneous nerve. It defcends upon the infide of the arm, and is tied down by the fafcia, and then paffes behind the internal condyle of the humerus. While above the bend of the arm, it gives off a fuperficial branch to the integuments on the infide of the arm, and the ulnar fide of the fore-arm ; at the fame time it fends a mufcular branch through the triceps mufcle, along with the arteria profunda inferior. Immediately above the elbow joint, twigs are fent off, fome of which accompany the

ramus

ramus anaſtamoticus major of the brachial artery. After paſſing the condyle of the humerus, it ſends a branch to the flexor carpi ulnaris, and to the head of the flexor digitorum profundus. It then ſinks deeper betwixt the flexor ulnaris and flexor digitorum ſublimis; it is here connected with the ulnar artery, and deſcends along with it to the wriſt. In this courſe, along the fore-arm, the ulnar nerve gives branches to the flexor digitorum ſublimus. Often it ſends a branch of communication to the radial nerve, while ſome few leſſer muſcular nerves are ſent off, and accompany the branches of the ulnar artery.

When arrived near the wriſt, the ulnar nerve divides into two branches. The continued trunk paſſes on under the protection of the tendon of the flexor ulnaris, and then under the annular ligament into the palm of the hand; while the branch takes a turn under the flexor ulnaris, and over the edge of the flexor digitorum profundus. It paſſes then over the lower end of the ulna to the back of the hand. On the back of the hand it is found branching over the expanded tendons and under the veins, and is finally diſtributed to the back of the little and ring fingers. This is the *ramus poſticus*.

The continued ulnar nerve paſſes under the palmaris brevis muſcle and palmar apponeuroſis, and above the flexor brevis and adductor minimi digiti. Here it divides into two, (the ſublimis and profundus of Camper,) and theſe again into four principal branches—to the integuments on the ulnar edge of the hand, and adductor minimi digiti—to the outer edge of the little finger,—to the ſide of the little and ring fingers, and a branch which communicates with the radial nerve.

Albinus, Monro and Camper differ in regard to the diſtribution of nerves to the lumbricales muſcles, which only proves that the twigs paſſing to thoſe little muſcles are irregular. They come chiefly from the deep branch of the ulnar nerve, whilſt others are from the radial nerve.

7. The MUSCULAR SPIRAL NERVE. We find the external cutaneous nerve, or perforans Caſſerii, paſſing

before

before the arm-bone. The mufcular fpiral nerve paffes behind the bone, and takes a fpiral turn under it to get to the outfide of the arm. It perforates the flefh of the arm betwixt the middle and the fhort head of the triceps mufcle. Before it perforates the triceps mufcle, the mufcular fpiral fends off branches which pafs over the tendon of the latiffimus dorfi ; and before it enters the triceps mufcle, it may be obferved to divide into feveral branches. Three of thefe may be mentioned : a branch to the middle head, and one to the fhort head of the triceps mufcle, and a third and larger nerve which pierces betwixt the mufcles, along with the trunk of the nerve.

This laft nerve does not follow the trunk of the nerve in its courfe, but perforating the triceps more directly acrofs, it comes out behind the fupinator longus, where it takes its origin from the os humeri. This is a cutaneous branch, and might be confidered as the external cutaneous nerve with as much propriety as the perforans Cafferii. Often we fhall find fome leffer branches of the mufcular fpiral nerve piercing the fibres of the triceps mufcle, and terminating in the fkin.

The great cutaneous divifion of the nerve, after piercing the triceps mufcle, takes its courfe along the integuments covering the fupinator longus mufcle ; and here it fends a branch in upon the bend of the arm, and on the edge of the triceps mufcle. It then defcends upon the outfide of the fore-arm, and divides into three principal branches, and then again into innumerable cutaneous twigs, and is continued down over the back of the thumb and hand.

But the great divifion of the mufcular-fpiral nerve comes out betwixt the head of the fupinator longus mufcle and the bone, and is deep feated. This branch then lies betwixt the fupinator longus, and brachialis internus ; and here it gives off feveral fmall twigs to the mufcles. Continuing its courfe by the fide of the fupinator longus and flexor radialis, it divides into a deep and fuperficial branch. The fuperficial branch paffes

2   down

down on the fide of the tendon of the fupinator longus, and near the wrift it becomes quite fuperficial, and is diftributed to the integuments of the back of the hand.

8. The INTERNAL CUTANEOUS NERVES. Of thofe we may defcribe three :—

1. The *great internal cutaneous nerve*. This nerve is derived from the ulnaris at its root, or comes off from the plexus along with it, paffes down the arm, giving off no confiderable branches, accompanies the bafilic vein and twifts its branches over it, divides into four branches upon the fafcia of the fore-arm, and running betwixt the fafcia and veins of the fore-arm, it is finally diftributed to the cellular membrane and integuments, while one of its branches reaches to the ligaments of the wrift.

2. The *cutaneous nerve of Wrifberg* comes fometimes from the axillary plexus, as a diftinct nerve; fometimes it is a branch of the great internal cutaneous nerve; fometimes it is derived, or a nerve which takes its place is derived from the intercoftal nerves. This nerve of Wrifberg is diftributed to the integuments of the arm, and terminates near the internal condyle.

3. The *upper and internal cutaneous nerve* comes from the firft intercoftal nerve, or from the fecond, and paffes out betwixt the firft and fecond ribs. It fupplies the integuments of the arm, and the glands and fat of the axilla *.

There are befides feveral nerves derived from the intercoftal nerves, which crofs the axilla, and fupply the arm-pit and fide.

NERVES OF THE THIGH, LEG, AND FOOT.

IN tracing the nerves of the lower extremity, we find no difficulty in the arrangement at leaft, for they fall into a very fimple and natural order. They are

* See Syftem of Diffections, vol. ii. plate 1. g.

all

all derived from the lumbar and facral nerves. The great nerves are three in number. One paffes out under Poupart's ligament to the extenfor mufcles of the leg, *viz.* thofe which lie on the fore-part of the thigh. This of courfe is called the anterior crural nerve. The fecond nerve is the obturator nerve, fo called becaufe it paffes out from the pelvis by the thyroid hole. This nerve lies amongft the deep mufcles of the thigh, and diftributes its branches chiefly to the adductor mufcles. The third nerve is the greateft nerve of the body, *viz.* the ifchiatic nerve. It paffes out from the back part of the pelvis, through the facro-fciatic notch, and takes its courfe down the back of the thigh into the ham. In this courfe it fupplies the mufcles lying on the back of the thigh, but its chief deftination is to the leg and foot.

OF THE CUTANEOUS NERVES OF THE THIGH.

IT will be found confiderably to take from the intricacy of the minute anatomy of the nerves of the lower extremity, to difpofe firft of thefe nerves which lie under the integuments of the thigh.

Thefe cutaneous nerves of the thigh come from the lumbar nerves, or more immediately from the anterior crural nerve. They pierce the tendon of the oblique mufcle of the abdomen, or pafs under Poupart's ligament, and are diftributed to the groin, fcrotum, and betwixt the fafcia and integuments of the fore-part of the thigh. There may be defcribed five cutaneous nerves on the fore-part of the thigh, *viz.* the *external cutaneous*, the *middle cutaneous*, the *anterior cutaneous*, the *internal cutaneous*, and thofe of the groin and fcrotum.

The EXTERNAL CUTANEOUS NERVE is that which comes out from the belly near the fuperior fpinous procefs of the ilium. It divides almoft immediately into two great branches, and in the front view of the thigh the anterior branch alone is to be feen. It takes a courfe above the fafcia in the direction of the line which divides

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the vaſtus externus from the rectus femoris, and termi-
nates near the knee, while the poſterior branch paſſes
over the tenſor vaginæ femoris, and down upon the out-
ſide and back of the thigh. It is derived from the
third lumbar nerve.

The MIDDLE CUTANEOUS NERVE is ſeen amongſt
the integuments of the groin, and emerges from under
the faſcia near the upper edge of the Sartorius muſcle.
It paſſes down upon the rectus muſcle, and is diſtributed
to the integuments in three or four diviſions.

The ANTERIOR CUTANEOUS NERVE comes out to
the integuments very high up, in the middle of the
groin betwixt the pubes and ſpine of the os ilii. It paſ-
ſes down the thigh along the ſurfaces of the Sartorius
and vaſtus internus muſcles. This, like all the other
cutaneous nerves, runs above the faſcia, and immediately
under the ſkin.

The INTERNAL CUTANEOUS NERVE is the leaſt re-
gular. It does not pierce the faſcia in one trunk, but
ſends three, four, or five branches through the faſcia,
which are diſtributed to the integuments on the inſide
of the thigh. Some of theſe, after running a conſider-
able way under the faſcia, emerge and encircle the in-
ſide of the knee.

Beſides theſe more remarkable cutaneous nerves,
there come down ſmall nerves to the groin and ſcrotum.
The firſt lumbar nerve ſends down the external ſperma-
tic nerve. This joining the ſpermatic plexus, helps to
ſupply the cord and teſticle; and in women the ſame
nerve goes to the womb within the pelvis, and follow-
ing the round ligament, terminates on the fat of the
pubes and groin. A branch from the ſecond lumbar
nerve paſſes alſo to the glands and fat of the groin, the
pubes, and cremaſter muſcle. This branch is remark-
able for the circuitous courſe it takes round the ilium
and inſide of the ligament of the thigh.

ANTERIOR CRURAL NERVE *.

THIS nerve arifes from the union of the fecond, third, and fourth of the lumbar nerves, or the fecond and third lumbar nerves uniting into one trunk, are afterwards joined by a divifion of the fourth †, or the anterior crural, is formed by the anterior branch of the third and the firft branch of the fecond lumbar nerve ‡, or by the four firft lumbar nerves; and the firft facral nerve. At its origin, it lies under the pfoas magnus, and, as it defcends, it holds its courfe between the pfoas magnus and iliacus internus. It then defcends towards the thigh, and paffes out under Poupart's ligament; and in its courfe along the brim of the pelvis, it is for fome way covered by the external iliac artery. Here, while within the pelvis, it gives off feveral fmall nerves, which pafs into the iliacus internus, and under the pfoas magnus mufcles. Thefe form a kind of fmall plexus.

As the anterior crural nerve paffes under Poupart's ligament, it fplits into its numerous branches which fupply the mufcles and integuments on the fore-part of the thigh. From the fore-part of the nerve there is fent out a mufculo-cutaneous branch, which, while it defcends and fupplies feveral of the mufcles of the thigh, gives out the middle cutaneous nerve. The anterior cutaneous nerve is fent off lower down. But almoft immediately after it has paffed under Poupart's ligament, the internal cutaneous nerve is fent off from fome of thofe branches which run under the internal articular artery.

The laft of the cutaneous branches of the anterior crural nerve, and the moft important, is the NERVUS SAPHENUS, or CUTANEUS LONGUS. This is the chief cutaneous nerve of the leg; but it is to be diftinguifhed as a particular nerve, fo high as under the external arti-

* *Crural nerve, truncus lumborum, femoralis magnus.*
† Fifcher—Walter.   ‡ Sabatier and Haller.

cular

cular or circumflex artery, being a divifion of what is called the NERVUS LONGUS. This nerve is fometimes joined by a branch of the obturator nerve; and the mufcular branches which it gives off, pafs into the vaftus internus.

When we are diffecting in the courfe of the femoral artery, we have to obferve two nerves running parallel to, and connected with the fheath of the artery. That which is on the infide is the largeft, the courfe of which we fhall profecute. It follows the artery through the tendon of the triceps mufcle, but it does not defcend into the ham with the popliteal artery. It comes out again through the tendon with the perforating branches of the popliteal artery, or with the upper and internal articular artery. It then becomes a fuperficial nerve, and defcends upon the infide of the leg with the faphena vein, to the inner ancle and foot.

Thofe two nerves, which are fo clofely connected with the femoral artery in the middle of the thigh, are very often taken up with the extremity of the artery in amputation. This occafions twitching in the ftump and a fetid difcharge.

Where the continued nerve defcends upon the infide of the leg, it fends out many twigs to the integuments, and is entangled with the faphena vein. Here it has been pricked in bleeding in the ancle.—Sabbatier gives us an inftance of this. The patient had been previoufly fubject to nervous affections. She felt in the inftant of the operation an acute pain, which was fucceeded by convulfive motions, firft of the limb and then of the whole body. Thefe attacks returned from time to time, fhe loft her health, and for many years was ftill in fuffering almoft continual. He relates to us another inftance of the injury of this nerve accompanying the faphena vein, in the cafe of a young man who received a wound with the fmall fword in the infide of the knee. There came on much fever and fwelling of the part, with great pain of the limb. This fubfiding, there followed flight trembling of the limb, which gradually increafed

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to an extreme degree. The cauftic was propofed, but the patient had not refolution to let it be applied. After long fuffering with exhaufted ftrength, he was at laft relieved by nature, and his health gradually returned.

Thefe branches we have mentioned are only the cutaneous or fuperficial branches of the anterior crural. The larger and more numerous fet of branches are thofe to the mufcles lying on the fore-part of the thigh. Thefe diverge fuddenly into innumerable twigs, and are entangled with the branches of the arteries, and follow them in their diftribution. There can be no excufe for beftowing particular names on thefe branches ;—to fay that one is the branch to the pectinalis, another the branch to the Sartorius, another to the rectus, &c. is fufficient.

OBTURATOR NERVE.

This nerve arifes by fafciculi from the fecond and third lumbar nerves, and fometimes by a fmall twig from the fourth. It is formed, however, chiefly by the third lumbar nerve. It then lies under the internal border of the pfoas magnus. It defcends into the pelvis, and goes obliquely downwards to pafs through the ligamentous membrane which fills up the thyroid hole. The obturator nerve, before it efcapes from the pelvis, fends off a branch which, accompanying the parent nerve, is given to the external obturator mufcle. When it has efcaped from the pelvis, this nerve lies before the heads of the triceps, and behind the pectinalis mufcle ; and it here divides into two branches in the very middle and internal flefh of the thigh. The anterior of thefe branches paffes down betwixt the adductor mufcles, or heads of the triceps, fupplies thofe mufcles and the gracilis, and fends a branch of communication with the faphenus nerve. The pofterior divifion goes down betwixt the adductor magnus and brevis, fends branches to the obturator externus and adductor brevis, and continues its courfe downward before the great flefhy parti-
tion

tion of the adductor mufcles, and parallel with the crural veffels, to the fat above the inner condyle of the femur.

THE ORIGIN OF THE ISCHIATIC NERVE.

The ifchiatic nerves is formed by the two laft nerves of the loins, and the three firft of the facrum : or we may defcribe its origin more particularly thus ; the anterior branch of the fourth lumbar nerve and the trunk of the fifth uniting, form a ftrong cord of about two inches in length : this root is joined to another nearly as large, formed by the firft and fecond facral nerves ; and again, a third divifion joins it from the inferior branch of the fecond facral nerve and from the third *. The ifchiatic nerve is thus formed of three great roots matted together into a kind of plexus, and then paffes betwixt the pyriformis mufcle and the gemini, and thus efcapes from the back part of the pelvis by the great ifchiatic notch.

But before following this great nerve into the thigh, we muft take notice of many leffer nerves fent out from the facral nerves, and from the trunk of the ifchiatic nerve. Thefe nerves pafs to the mufcles and integuments of the nates and back of the thigh to the perineum and private parts.

OF THE LESSER NERVES WHICH GO OUT FROM THE BACK PART OF THE PELVIS.

1ft. There pafs off branches from the fecond and third lumbar nerves, which form a mufcular nerve of confiderable fize. This mufcular nerve paffes down upon the infide of the pelvis, efcapes from the back part of the pelvis, and is diftributed to the gluteus

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* This third and loweft origin, before uniting with the others to form the ifchiatic nerve, gives out many fmall branches to the hypogaftric plexus and vifcera of the pelvis, to the perineum and private parts.

medius,

medius, the gluteus minimus, and the tenfor vaginæ femoris.

2. There pafs off one or two very fmall nerves from the body of the ifchiatic nerve, while yet within the pelvis, or from the middle divifions of its origins, which go to the pyriformis and gluteus medius mufcles.

3. Juft where the great nerve paffes over the pofterior ligaments of the pelvis, there goes off a twig to the obturator externus, gemini, and quadratus femoris. While thefe nerves are fent off upon the anterior face of the nerve, there goes backward a large fafciculus of nerves to the glutei mufcles, and to the integuments of the nates *.

There proceeds a nerve fomewhat more important than thefe from the third facral nerve, viz. the NERVUS PU-DENDUS. This nerve paffes out above the fhort facro-ifchiatic ligament, and re-enters under the long facro-ifchiatic ligament. It then runs by the fide of the ramus ifchii, and afcends in the perineum and branches to the erector penis, accelerator urinæ, and tranfverfalis perinei, and paffes on to the integuments and external parts of generation.

OF THE CUTANEOUS NERVES OF THE BACK OF THE THIGH.

WHEN the integuments are diffected off from the nates and back of the thigh, we fee two fources of the cutaneous nerves ; firft from the lumbar nerves, which give out many fmall nerves which pafs over the fpine of the os ilii, and the branches of the anterior and outer cutaneous nerve ; and fecondly, from under the lower margin of the great gluteus mufcle, there come many extenfive cutaneous nerves. Thefe are derived from the

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* Branches of that root of the ifchiatic nerve which is derived from the third facral nerve, go alfo out to the buttock ; and fome defcribe a fuperior, middle, and inferior cutaneous nerve of the nates.

nervus cutaneus pofterior et fuperior, and branches of the ifchiatic nerve, in this manner;

Juft as the great ifchiatic nerve has efcaped from the pelvis, it is joined by the SUPERIOR and POSTERIOR CUTANEOUS NERVE; or, rather, a fmall twig is fent off from the great nerve to join this cutaneous nerve * on its emerging from the pelvis. It divides into feveral branches, and it is one of thefe which may be feen fuperficial and above the delicate fafcia, running down upon the outer ham-ftring mufcles, to the back of the knee-joint. Another branch piercing the fafcia feparately, comes down upon the integuments covering the outer and back part of the thigh, and terminates on the outfide of the knee. A little further down, the ifchiatic nerve gives off fmall nerves to the mufcles furrounding the hip joint; and, whilft the fciatic nerve is paffing over the quadratus femoris, the INFERIOR and INTERNAL CUTANEOUS NERVE is given off. This nerve runs down even to the infide of the calf of the leg.— The EXTERNAL and POSTERIOR CUTANEOUS NERVE is a branch fent off from the ifchiatic nerve, after it has defcended from under the gluteus maximus, and juft before its divifion into two fafciculi, viz. the tibial and peroneal nerves. This external and pofterior cutaneous nerve paffes down upon the integuments of the back part and outfide of the leg.

OF THE TRUNK OF THE ISCHIATIC NERVE IN THE THIGH.

BUT we muft not allow thefe leffer branches to diftract our attention from the general courfe of the great nerve, which paffes over the gemini mufcles, betwixt the tuberofity of the ifchium and the trochanter major, then runs deep under the bellies of the hamftring muf-

* The pofterior cutaneous nerve rifes in general from the trunk of the ifchiatic nerve, within the pelvis, and is joined by a branch from the third facral nerve.—Ioerd. Haafe.

cles,

cles, and is lodged immediately in the great cavity behind the knee-joint, in company with the popliteal artery and vein. In this courfe the facro-fciatic gives off branches to the quadratus femoris, the biceps cruris, femitendinofus and femimembranofus and triceps.

A little below the middle of the thigh, the great ifchiatic nerve divides into the internal and greater, and the leffer and external popliteal nerves. But as this is really the divifion into the two great nerves of the leg, we take the more determinate names of tibial and fibular nerves.

TIBIAL NERVE.

THE greater and more internal of thefe divifions of the popliteal nerve, is the tibial nerve. Whilft it is yet in the hollow behind the joint formed by the hamftring tendons, it gives off a nerve which comes out from the ham, and defcends fuperficially on the back of the leg. This has been called RAMUS COMMUNICANS TIBIALIS. When this nerve has arrived oppofite to the beginning of the tendon Achillis, it turns a little to the outer fide, paffing upon the outer margin of the Achillis tendon, over the outer fide of the heel-bone, and is finally diftributed on the outfide and fore-part of the foot. Upon the back of the leg, this nerve unites with a branch defcending from the fibular nerve, nearly in the fame courfe, and with the fame deftination.

After giving off this fuperficial branch, the tibial nerve fends branches to the back of the knee-joint and popliteus mufcle, to the plantaris mufcle, and to both heads of the gaftrocnemius. It then defcends behind the articulation, and behind the head of the tibia. It then paffes under the origins of the foleus, and betwixt the foleus and flexor longus digitorum pedis, and tibialis pofticus, and defcends to the inner ancle. In this courfe it furnifhes many branches to the lower part of the popliteal mufcle, to the tibialis pofticus, to the flexor communis digitorum, and to the flexor pollicis longus, and many of thefe branches, end in cutaneous twigs. We

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have alſo to obſerve a particular branch which the tibial nerve detaches, which paſſes betwixt the heads of the tibia and fibula, and goes to ſupply the muſcles ariſing from the fore-part of the interoſſeous ligament. Further down, two or more ſmall branches of the nerve alſo perforate the interoſſeous ligament, to ſupply the muſcles lying on the outſide of the tibia. The tibial nerve, in its courſe amongſt thoſe poſterior muſcles, accompanies the poſterior tibial artery. When it has arrived behind the inner ancle, it ſends off a branch to the integuments of the inſide of the foot, and to the abductor muſcle of the great toe. Continuing its courſe by the ſide of the heel-bone and under the ligament, it begins to ſplit into thoſe branches which are naturally called the plantar nerves, becauſe of their lying in the ſole of the foot.

THE PLANTAR NERVES.

THE internal plantar nerve paſſes over the abductor muſcle of the great toe, and by the inſide of the ſhort flexor to the firſt metacarpal bone ; and in this courſe it gives out ſeveral twigs to the muſcles of the ſole of the foot. It now divides into three branches. Theſe are diſtributed to the great toe, to the ſecond, the third, and one ſide of the fourth toes ; and theſe nerves in their courſe give branches to the lumbricales and interoſſii muſcles.

The external plantar nerve is the leſſer of the two. It gives branches to the ſhort flexor and adductor of the little toe, and to the maſſa carnea Jacobi Silvii. It gives alſo a deep branch to the third and fourth interoſſeous muſcle and adductor muſcle of the great toe. Another of its branches makes the arch with the internal plantar nerve, while its extreme diſtribution is to the little toe, and to one ſide of the fourth toe. Theſe nerves of the ſole of the foot are connected with the internal and external plantar arteries, and are protected like them by the plantar aponeuroſis.

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THE FIBULAR NERVE.

THE fibular nerve is the more external divifion of the popliteal nerve. It feparates from the tibial branch about four inches above the knee-joint; it does not pafs down under the gaftrocnemius, like the tibial nerve, but turns towards the outfide of the joint, and paffes round the head of the fibula, and under the origin of the peroneus longus.—Before the fibular nerve paffes from behind the joint, it gives off feveral branches. There are fent down two branches to the integuments. One of thefe branches unites with the communicans tibialis, and defcends with it to the outer ancle. Sometimes this anaftamofis is formed high in the leg upon the heads of the gaftrocnemius. More generally there is a double communication formed by thefe nerves about the termination of the belly of the gaftrocnemius mufcle in the Achilles tendon. This prolonged branch of the fibular nerve terminates upon the fide and upper part of the foot, and upon the little toe. There are alfo fome nerves fent off from the fibular, which are diftributed about the back and fides of the knee-joint.

When the fibular nerve has turned over the head of the fibula, it divides into two great branches. The DEEPER SEATED OF THESE BRANCHES, though it is not the largeft of them, may be confidered as the continued trunk. It paffes deep amongft the mufcles, lying betwixt the tibia and fibula, and fupplies the tibialis anticus, the extenfor communis digitorum, extenfor longus pollicis, and the peroneus brevis. Thus the deeper divifion of the fibular nerve, taking its courfe between the tibialis anticus, and the peroneus longus mufcles, and lower down betwixt the tibia and extenfor pollicis longus, continues giving off branches in rapid fucceffion, and when it arrives at the anular ligament, it is much diminifhed. Here it divides into the *ramus dorfalis pedis profundus,* and *fuperficialis.*—This divifion is
made

made after the nerve has croffed under the tendon of the tibialis anticus mufcle, and, while it lies betwixt the lower heads of the tibia and fibula.—Although they are diftinguifhed by the name of deep and fuperficial branches, they are both deep compared with the extre-mities of the great and outer divifion of the peroneal nerve. The branch which lies moft towards the outfide of the foot, paffes under the extenfor digitorum brevis mufcle, and on the outfide of the tarfus. It diftributes its branches to the extenfor digitorum brevis, and inte-roffii mufcles. That branch which is more towards the infide of the foot, although diftinguifhed by the term fuperficialis, goes forward not only under the fafcia which covers the foot, but alfo under the tendons ; and after dividing and again uniting, and after fending off fome fmall branches, it comes out betwixt the great toe and the fecond toe, and fends numerous branches to their contiguous furfaces.

The GREAT SUPERFICIAL DIVISION of the FIBULAR NERVE is fometimes double, or immediately fplits into two. Its firft branches are to the peroneus tertius, ex-tenfor longus digitorum, and to the peroneus brevis and fecundus. The trunk or principal divifion runs down under the head of the peroneus longus, and then com-ing out from under it, continues its courfe beneath the ftrong aponeurofis, which covers the mufcles on the fore-part of the leg. It then pierces the aponeurofis and becomes cutaneous, and runs obliquely down to the convexity of the foot, giving off in its courfe a nerve which paffes over the outer ancle.

THE METATARSAL NERVES.

WHEN the fuperficial branch of the peroneal nerve defcends before the ancle-joint, it divides into the me-tatarfal nerves, or the rami dorfales pedis. The EXTER-NAL of thofe branches paffes above the tendons, and above the tendinous expanfion on the dorfum pedis ; is united to the extreme branches of the ramus com-

municans

municans tibiæ, and is finally diftributed to the outfide
of the third toe, to the fourth, and to the infide of
the little toe.—The INTERNAL branch is again fubdi-
vided ; one branch extends over the middle of the foot
to the fecond and third toes, while the other paffes
ftraight along the metatarfal bone of the great toe
(above the tendons) ; fends many branches over the in-
fide of the foot, and terminates on the infide and dor-
fum of the great toe.

END OF THE SECOND VOLUME.